TECHNOLOGY DEPT.

ROADS AND STREETS

FEBRUARY 1946

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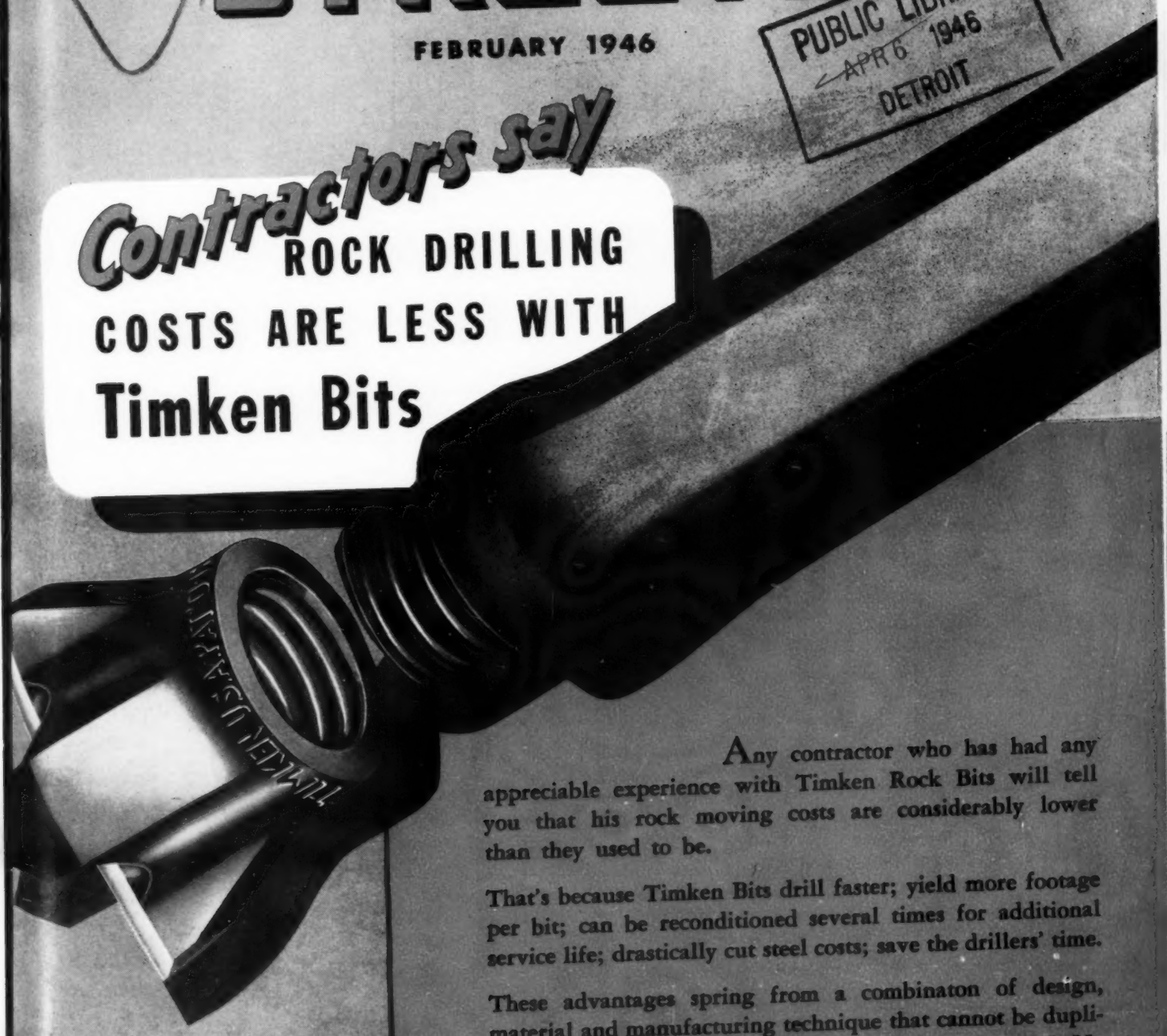
DETROIT

Contractors say

ROCK DRILLING COSTS ARE LESS WITH

Timken Bits



Any contractor who has had any appreciable experience with Timken Rock Bits will tell you that his rock moving costs are considerably lower than they used to be.

That's because Timken Bits drill faster; yield more footage per bit; can be reconditioned several times for additional service life; drastically cut steel costs; save the drillers' time.

These advantages spring from a combinaton of design, material and manufacturing technique that cannot be duplicated. No other bit manufacturer makes his own steel. No other bit manufacturer has the benefit of such far-reaching metallurgical knowledge and experience.

If you've never used Timken Bits you don't know what you're losing. Write for name of nearest authorized distributor. The Timken Roller Bearing Company, Canton 6, Ohio.

TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

ROCK BITS

Speaking of POSITIONS

ADAMS Gives You ALL These with Blade Centered on Circle

AN EXTREMELY wide range of blade positions—*obtained without mechanical adjustments*—is one of the important operating advantages which has made Adams Motor Graders top favorites the world over.

Quickly, easily, Adams fast power-operated blade controls—conveniently located at operator's finger tips—accurately position the blade for virtually all surface, ditch and bank work . . . *without shifting blade on circle or even adjusting blade lift links!*

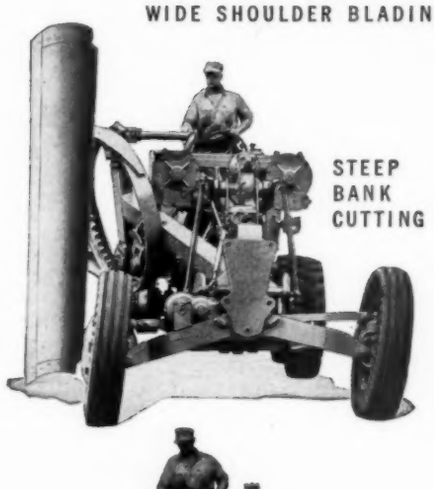
Occasional cuts, which call for unusual blade positions, are easily handled through simple adjustment of telescopic lift links. Only where extreme blade positions are demanded is it ever necessary to shift blade on the circle.

Discover how this, and other Adams' superiorities, will speed operations, increase efficiency and reduce costs . . . for you! For complete information visit or phone your near-by Adams dealer.

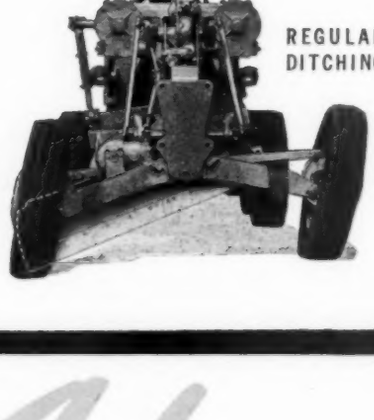
J. D. ADAMS MANUFACTURING CO., Indianapolis, Indiana

REVERSE DITCHING OR BLADING

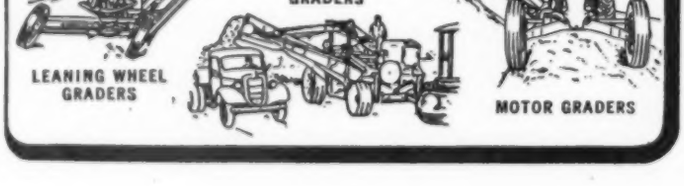
WIDE SHOULDER BLADING



STEEP BANK CUTTING



REGULAR DITCHING



Adams

ROAD-BUILDING AND EARTH-MOVING EQUIPMENT

Bethlehem Guard Rail

Today, with steel guard rail an important part of so many highway programs, you'll find the Bethlehem line hard to beat.

When a runaway vehicle leaves the pavement sidewise—as happens in most accidents—there's a lot of safety in a Bethlehem Cable Guard Rail, mounted on Bethlehem Steel Guard Posts with Bethlehem Guard Brackets. The standard Bethlehem guard is made of durable, double-galvanized ¾-in. 3-strand cable, good for years of service. Properly-driven Bethlehem Guard Posts resist impact and side-thrust as well as, or better than, other kinds of posts. And the Bethlehem Highway Guard Bracket, which is made of high-tension spring steel, holds the cable and takes up much of the shock. When a one-piece guard rail is desired, there's the Bethlehem beam-type Safety-Beam rail, which no car can break through. Tough and smooth, it is made in standard lengths of 12 ft., 6 in., or can be supplied in lengths up to 50 ft.

These Bethlehem products are rugged and economically-designed—built to last, as are all of Bethlehem's line of highway steel products.

By ordering all the steel needed for a highway job from Bethlehem you'll get quick, reliable service—service that will save you money, paper-work and the possibility of idle men and equipment. It will pay you to buy steel from Bethlehem, for the big jobs ahead!

Bethlehem Safety-Beam Guard Rail

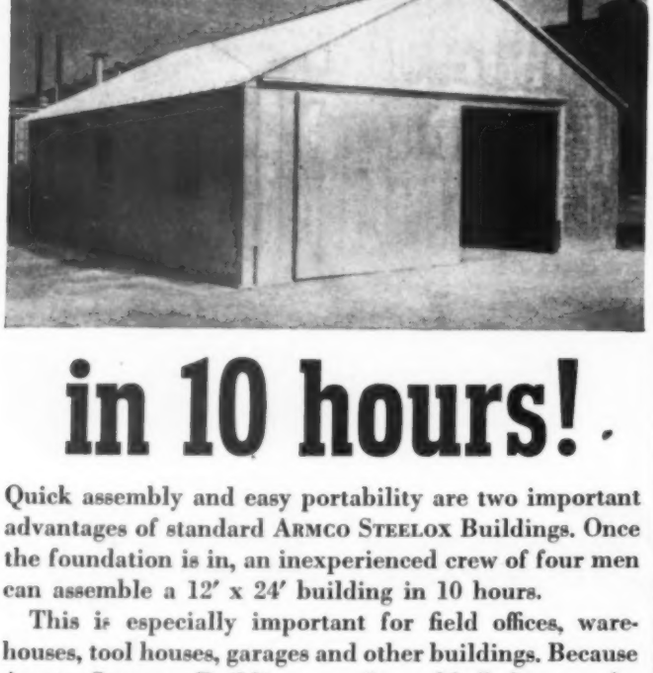
BETHLEHEM PRODUCTS FOR HIGHWAYS

Road Joints • Center Strip • Dowels Dowel Bar Supports • Reinforcing Bars Bar Mats • Bar Ties • Reinforcing for Concrete Pipe • Bridge Floor Reinforcing Concrete Slab Spacers • Welded Wire Fabric Guard Rails • Guard Posts and Brackets Wire Rope and Strand • Right-of-Way Fence and Posts • Anchor Rods • Pipe Hollow Drill Steel • Digging Bars • Structural Steel • Corrugated Sheets • Turnbuckles • Tie Rods, Spikes, Bolts and Nuts • Timber Bridge Hardware • Sheet and H-Bearing Piling

Full information about the Bethlehem line of road steels in our new illustrated catalog, "Steel for Highways," available through the nearest district office, or from Bethlehem Steel Company, Bethlehem, Pa.

★ BETHLEHEM STEEL ★

4 men
CAN ASSEMBLE THIS



in 10 hours!

Quick assembly and easy portability are two important advantages of standard ARMCO STEELOX Buildings. Once the foundation is in, an inexperienced crew of four men can assemble a 12′ x 24′ building in 10 hours.

This is especially important for field offices, warehouses, tool houses, garages and other buildings. Because ARMCO STEELOX Buildings are "portable," they can be moved from one location to another in less than a day! STEELOX panels can be salvaged 100% and re-used many times.

BONDERIZED FOR PAINTING

Prefabricated sections of STEELOX Buildings are durable. The Bonderized Galvanized PAINTGRIP surface can be painted immediately. STEELOX Buildings can be quickly wired, easily insulated. Tight flanges help prevent penetration of dust, insects or vermin. And all-steel construction is an excellent fire-barrier.

Get prices and the complete story of ARMCO STEELOX Buildings by writing Armco Drainage & Metal Products, Inc., and Associated Companies, 1045 Curtis Street, Middletown, Ohio.

ARMCO *Armco*

STEELOX BUILDINGS

ROADS AND STREETS

Vol. 89 FEBRUARY, 1946 No. 2

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A magazine devoted to the design, construction, maintenance and operation of highways, streets, bridges, bridge foundations and grade separations, and to the construction and maintenance of airports.

WITH ROADS AND STREETS HAVE BEEN COMBINED GOOD ROADS MAGAZINE AND ENGINEERING & CONTRACTING

HALBERT P. GILLETTE, President; EDWARD S. GILLETTE, Publisher; HAROLD J. McKEEVER, Editor; CHARLES T. MURRAY, Managing Editor; H. K. GLIDDEN, Eastern Editor (N. Y.); LT. COL. V. J. BROWN, Publishing Director (Absent on Military Duty); H. J. CONWAY, Advertising Editor; L. R. VICKERS, Promotional Director.

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ACTION SHOTS ON ALL "FRONTS"!

Contractors, quick to see the bigger profit possibilities in the new postwar Lorain 41 series, are losing no time in taking every advantage of front-end interchangeability.

These on-the-job camera shots graphically show how the Lorain is truly a multi-purpose machine. Huskier, heavier, but more agile, and crammed with new features and structural improvements, a Lorain handles dragline, clam shell, hoe, shovel or crane work with equal facility.

Four-star performers in this brilliant Lorain 41 line:

Lorain 41 chain drive crawler—features the new 30" wide swamp type treads.

Lorain Moto-Crane 414—6 wheels, rubber tired, 4-wheel drive.

Lorain Moto-Crane 416—6 wheels, rubber tired, 6-wheel drive.

Lorain Self-Propelled 414—6 wheels, rubber tired.

All available with gas, diesel or electric power.

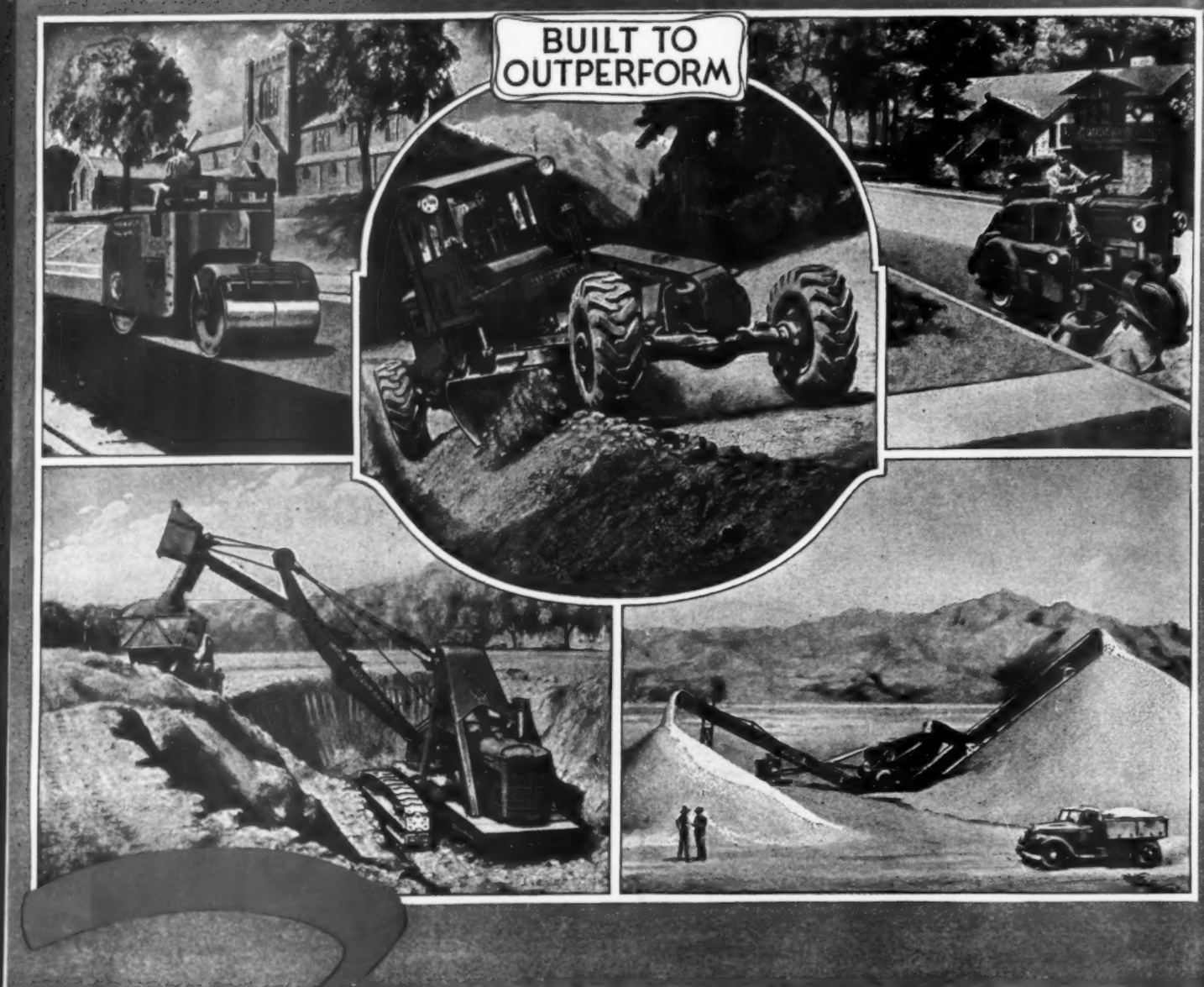
Get the *full* story of the new 41 Lorains from the nearest Lorain distributor to learn how a Lorain 41 can serve you on all the ranges of work that you will undertake in the busy years ahead.

Reg. Trade Mark

thew-Lorain

THE THEW SHOVEL CO.
Lorain, Ohio

CRANES • SHOVELS • DRAGLINES • MOTO-CRANES



Whether it's . . .

√ The matchless performance of All-Wheel Drive and All-Wheel Steer in a Power Grader . . .

√ Vibrationless operation in a Road Roller . . .

√ The "no conveyor" feature in a Street Sweeper . . .

√ ¾-swing for greater work output in a Crawler Shovel . . .

√ Deeper jaws and higher operating speeds, for greater capacity in a Jaw Crusher . . .

. . . whether it's one of these things, or something else, you can buy any Austin-Western product with confidence that it will OUTPERFORM in ways that mean more work and better work—faster and cheaper.

AUSTIN-WESTERN COMPANY, AURORA, ILLINOIS, U. S. A.

Built to Outperform

BUILDERS OF ROAD MACHINERY

Austin Western

SINCE 1859

Introducing

"CATERPILLAR" SCRAPERS

WITH THESE DISTINCTIVE FEATURES FOR "LOWEST COSTS ON EARTH"

1 "COMPLETE PACKAGE" EARTHMOVER

Tractor and scraper built to work together • One high standard of material and workmanship • One service source—the best in the business.

2 OPEN-BOWL DESIGN FOR:

Greater stability • Good visibility • Loading with shovel or dragline.

3 OPTIONAL TIRE SIZES FOR:

Correct flotation • Tires matched to the job • Minimum rolling resistance • Bigger pay-loads • Longer tire life.

4 DOUBLE-CURVED, SELF-SHARPENING CUTTING EDGES FOR:

"Live loading" with longer boiling action • Digging hard material • Shorter loading distance • Less loading time.

5 HIGH APRON LIFT TO CLEAR THE STICKIEST MATERIALS

6 POSITIVE, CLEAN EJECTION

7 LONG CABLE LIFE FROM:

Correct reeving • Over-sized, precision-grooved sheaves.

ANOTHER IN THE GREAT NEW LINE OF "CATERPILLAR" EARTHMOVING EQUIPMENT

First the bulldozers (recently announced), and now the *open-bowl* scrapers have gone into production. "Caterpillar" research projected them. "Caterpillar" engineering designed them. "Caterpillar" proving has okehed them after every conceivable test of performance — for mechanical efficiency, for work capacity, for long-lived stamina, for operating ease and economy.

As in every product "Caterpillar" offers, you may be sure that these scrapers are tops in the field — with features, materials and workmanship that give the earthmover undisputed profit advantages — per job or per life of product.

To individual mechanical superiority, "Caterpillar" Scrapers give you the further advantage of *one service source* when teamed up with "Caterpillar" Diesel Tractors . . . both made by the same manufacturer and kept in working condition by a single dealer organization unequaled for completeness.

See your "Caterpillar" dealer about these new "Caterpillar" Scrapers; about the new "Caterpillar" Bulldozers — and how, with "Caterpillar" Diesel Tractors, the advantages of ideally matched earthmoving equipment can be realized for the first time in construction history.

CATERPILLAR TRACTOR CO. • PEORIA, ILLINOIS

CATERPILLAR DIESEL

REG. U.S. PAT. OFF.

ENGINES • TRACTORS MOTOR GRADERS • EARTHMOVING EQUIPMENT

The discharged veteran wears this emblem. Remember his service and honor him.

Pedigree

CHRYSLER

Industrial Engines

"HORSEPOWER WITH A PEDIGREE"

CONCEPTION . . . BACK IN 1924, CHRYSLER INTRODUCED A NEW CONCEPTION OF THE INTERNAL COMBUSTION ENGINE — COMPACT, HIGH COMPRESSION, FLEXIBLE HORSEPOWER. TEN MILLION CHRYSLER-BUILT ENGINES PROVE THE VALUE OF THIS CONCEPTION.

HISTORY . . . FOR A FULL GENERATION CHRYSLER-POWERED VEHICLES, VESSELS AND EQUIPMENT HAVE ESTABLISHED NEW STANDARDS OF PERFORMANCE — A NEW EXCELLENCE OF QUALITY RESULTING FROM TIME-TESTED PRINCIPLES OF POWER APPLICATION.

RECORD . . . WITH BUILT-IN PRECISION AND ADVANCED ENGINEERING, CHRYSLER ENGINES HAVE DEMONSTRATED A STURDINESS AND STAMINA THAT MEET THE CHALLENGE OF DAY-IN, DAY-OUT, GRUELLING USE.

YIELD . . . CHRYSLER ENGINES IN THE COMMERCIAL, INDUSTRIAL, AGRICULTURAL AND MARINE FIELDS HAVE TURNED IN A PERFORMANCE THAT STAMPS CHRYSLER HORSEPOWER AS AN INVESTMENT THAT PAYS SUBSTANTIAL RETURNS IN DOLLARS AND CUSTOMER SATISFACTION.

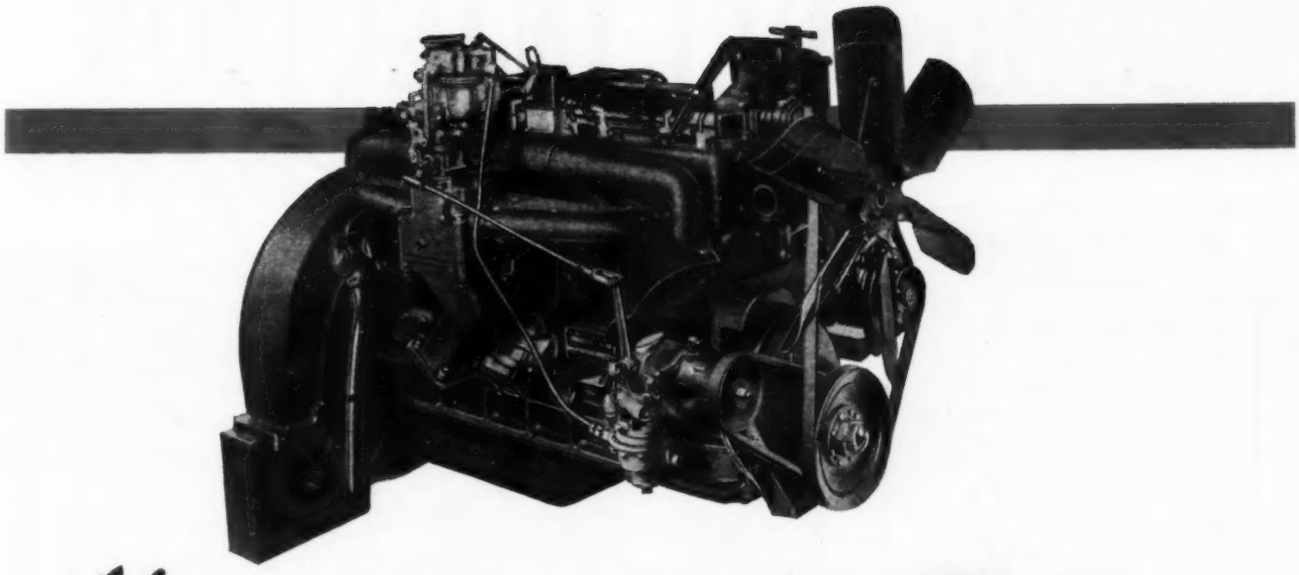
SUPERIORITY . . . EACH FEATURE IN DESIGN, CONSTRUCTION AND WORKMANSHIP IN CHRYSLER ENGINES IS COMPARABLE TO THE OUTSTANDING QUALITIES PROVIDED BY THE CHRYSLER SUPERFINISH OF MOVING PARTS AND ALL WEARING SURFACES.

LONGEVITY . . . CHRYSLER ENGINES STAND UP OVER THE YEARS BECAUSE THEY POSSESS A METALLURGICAL FINENESS — FROM CRANKCASE TO CYLINDER HEAD — THAT OVERCOMES THE STRESSES AND STRAINS OF EXPANSION AND CONTRACTION.

ENGINEERING . . . OVER 2,000 TECHNICIANS IN THE GREAT CHRYSLER ENGINEERING LABORATORIES HAVE CONTINUOUSLY PIONEERED AND DEVELOPED FEATURES IN ENGINE DESIGN THAT ASSURE BETTER PERFORMANCE WITH LOWER OPERATING AND MAINTENANCE COSTS.

RELIABILITY . . . FAST, SURE STARTING COUPLED WITH AN UNFAILING, DEPENDABLE POWER FLOW UNDER ALL LOADS AND AT VARYING SPEEDS, GIVE CHRYSLER ENGINES THE MARK OF A THOROUGHBRED — OUT IN THE FIELD WHERE CLASS TELLS.

CHRYSLER



Horsepower with a Pedigree

The legend of achievement in the modern world revolves around harnessing horsepower in gasoline engines. It is the force that has lightened man's labors and extended his entire sphere of usefulness and attainment.

Power in industry, on the farm and on the highways is mobile power, "packaged" to meet the needs of all types of equipment dependent on internal combustion engines as a source of energy.

Chrysler Corporation, for a generation, has been producing engines that have, year after year, reflected the scientific research and advanced engineering based on a new conception of dependable horsepower.

Each individual power plant is more than an engine—it is a unit of harnessed horsepower that possesses the fine qualities and character born of superior craftsmanship and tradition.

The hallmark of Chrysler is a pledge that places a new value of known performance traits in the hands of all users of Industrial engines. Here is "Horsepower With A Pedigree".

"OUT IN THE FIELD WHERE CLASS TELLS"

"LISTEN TO THE MUSIC OF ANDRE KOSTELANETZ, THURSDAYS, CBS, 9 P.M. EST."

CHRYSLER
INDUSTRIAL ENGINES
Horsepower with a Pedigree

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12207 East Jefferson, Detroit 14, Michigan

Please send the Chrysler Industrial Catalog.

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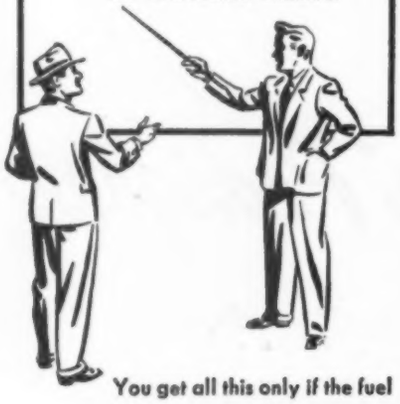
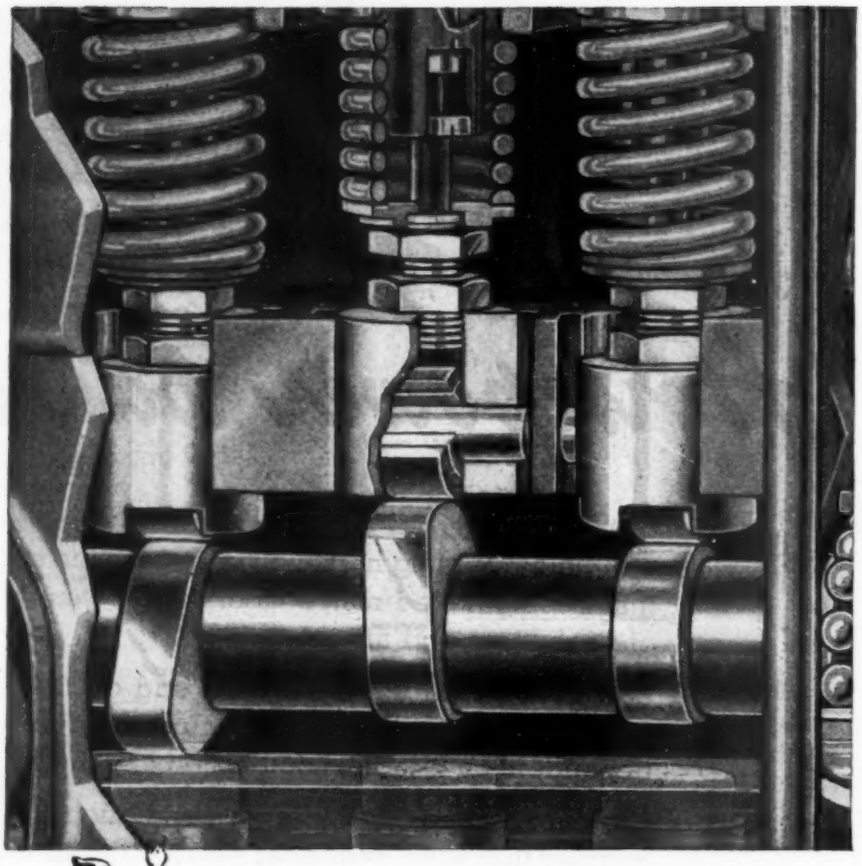
8

GOOD FUEL INJECTION
Fits the Engine

GOOD FUEL INJECTION PROVIDES:

A. Accurate Metering
B. Precise Timing
C. The Correct Duration
D. A Spray Pattern Tailored to the Combustion Chamber





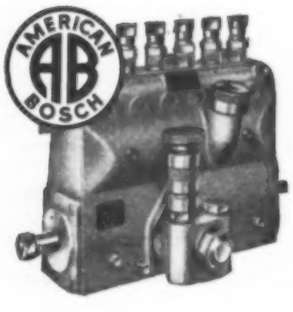
You get all this only if the fuel injection system has been engineered to fit the engine.

There are types of American Bosch injection equipment to suit all types of engines. The final engineering touches that make the equipment really *fit* involve the specially-designed or selected parts such as cams, plungers, delivery valves and nozzles.

●

THESE CAMS in the fuel pump, for example, are vital. They contribute importantly to control of the rate and duration of injection. They are engineered to co-operate smoothly with other elements of the fuel injection system to produce precisely the type of spray called for by the engine design.

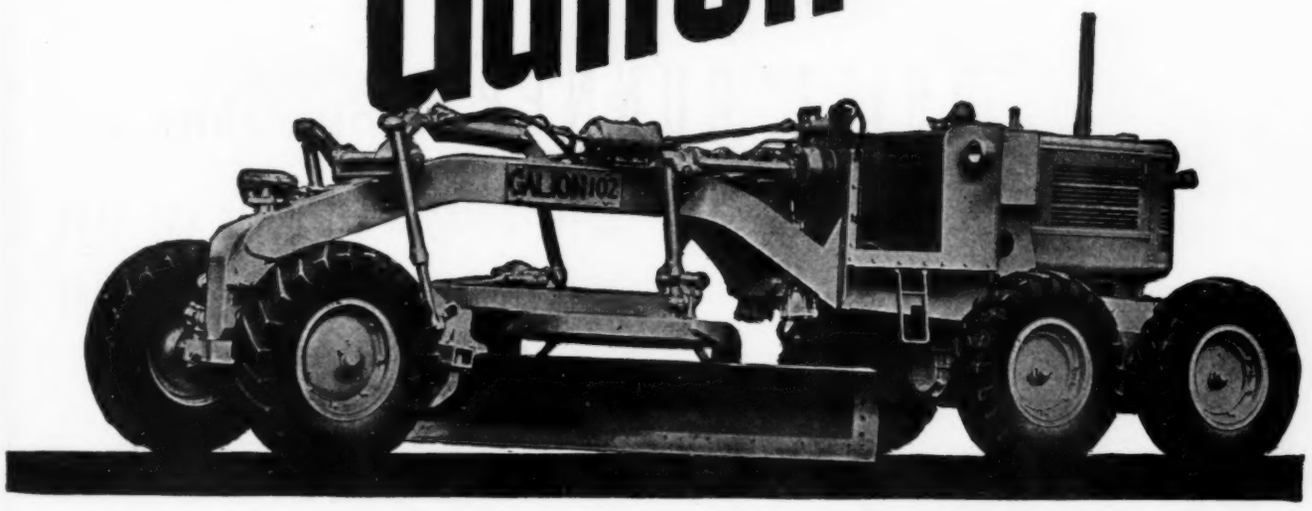
THEY CAN TAKE IT. If your engine has American Bosch injection equipment — the kind that is engineered to fit — you can be sure that it will perform to its very best in giving you economical service under any and all conditions.



AMERICAN BOSCH CORPORATION, SPRINGFIELD 7, MASS.

AMERICAN BOSCH
Diesel Fuel Injection

The Galion 102



● HERE IT IS: The Galion No. 102 — a worthy successor to the model 101 with which you are so familiar, and which made such a name for itself during the war period. Years of sound engineering and serious thought have gone into this new model 102, providing you with a motor grader which will meet all your requirements in road and airport construction — and maintenance. You'll like the Galion No. 102 and we want you to check into its many new and improved features if you are interested in a motor grader—BUILT RIGHT TO DO THE JOB RIGHT.

THE GALION IRON WORKS & MFG. CO.

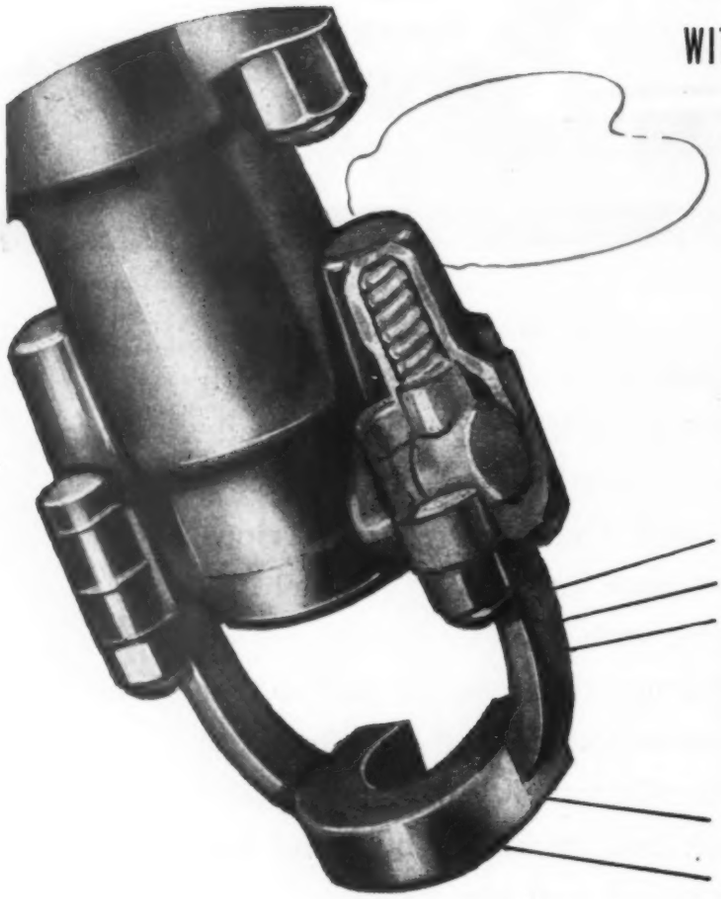
Main Office and Works: Galion, Ohio

DISTRIBUTORS EVERYWHERE

Why leading contractors

The DRILL RUNNER *knows that...*

STEEL CHANGES ARE QUICK AND EASY WITH THOR'S DIRT-PROOF, JAM PROOF STEEL RETAINER



You won't find an operator of a Thor Rock Drill carrying a hammer or pry-bar to pound the retainer free for steel changes . . . because the Thor retainer is easily opened by hand throughout the life of the tool. *Fully enclosed* to prevent jamming by dirt or rock, the tension spring in the Thor retainer cannot be over-tightened. Lubrication is done without dismantling the retainer so it *always* works easily to speed steel changes and reduce friction and wear.

This feature alone makes Thor Rock Drills *preferred* by operators. Add smooth performance and easy handling and you'll see why runners get more footage per shift—every shift—with Thor.

INDEPENDENT PNEUMATIC TOOL COMPANY
600 W. Jackson Boulevard, Chicago 6, Illinois

Birmingham Boston Buffalo Cleveland Detroit Los Angeles
Milwaukee New York Philadelphia Pittsburgh St. Louis
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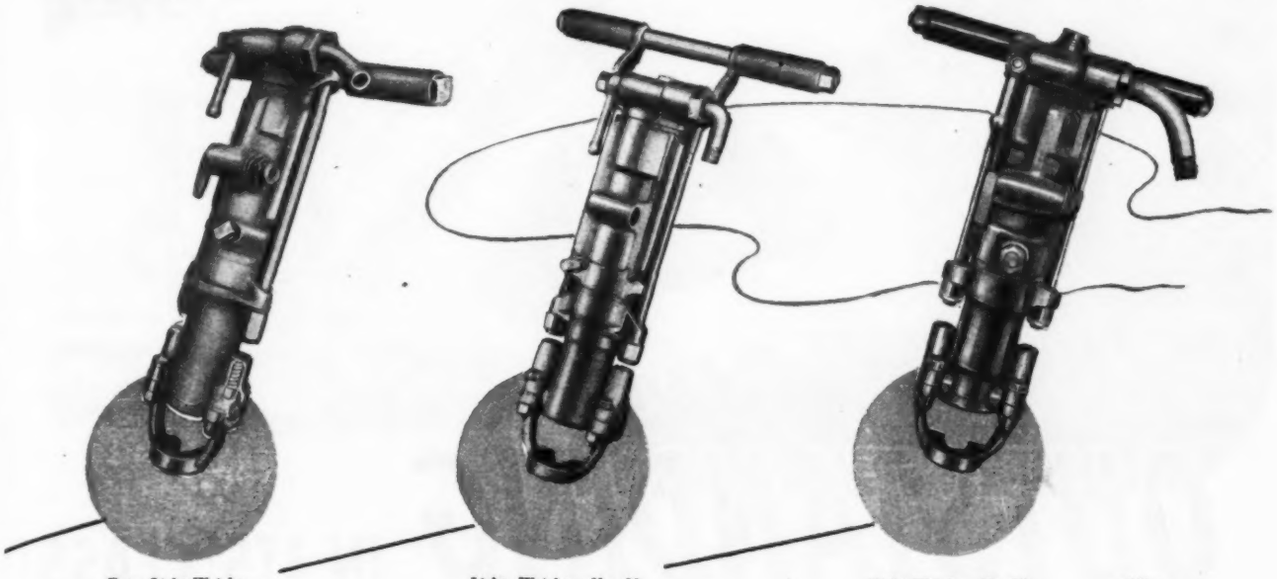
Thor PORTABLE POWER TOOLS

PNEUMATIC TOOLS • UNIVERSAL AND HIGH FREQUENCY ELECTRIC TOOLS • MINING AND CONTRACTORS TOOLS

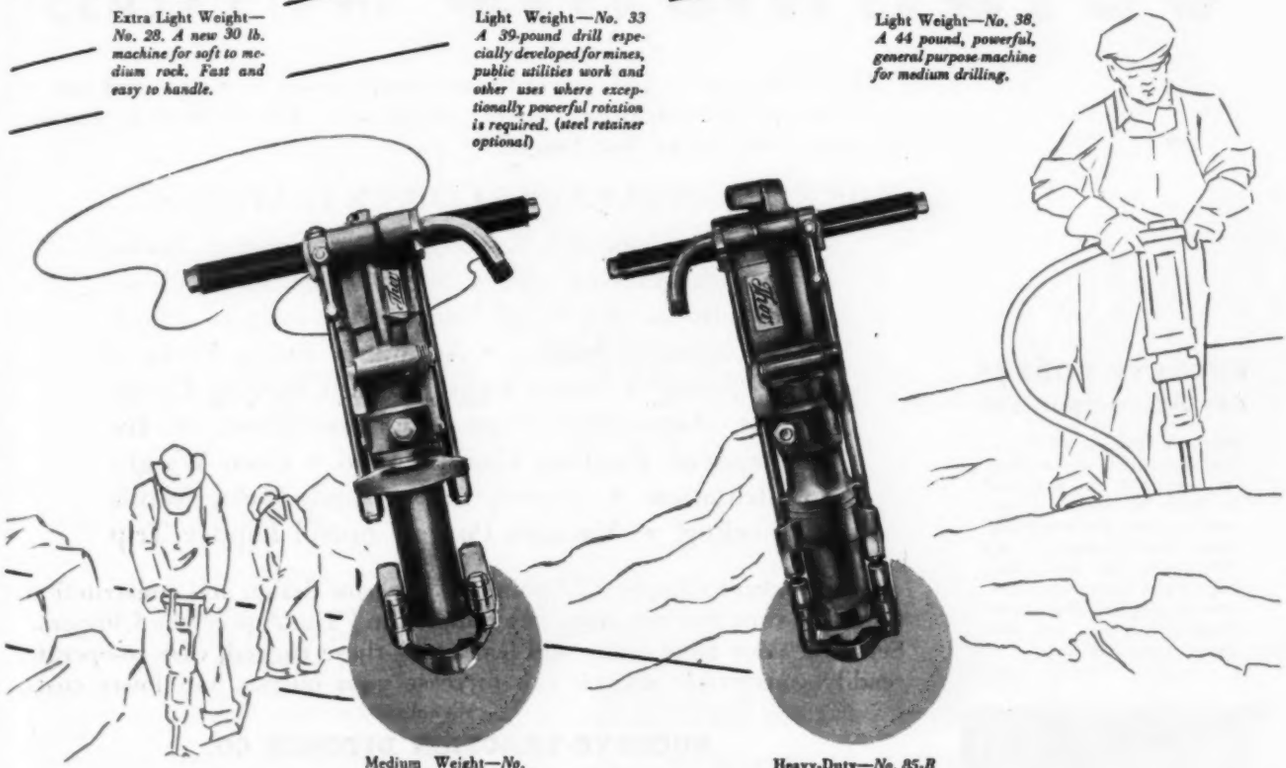
SPECIFY *Thor* ROCK DRILLS



Extra Light Weight—*No. 28. A new 30 lb. machine for soft to medium rock. Fast and easy to handle.*

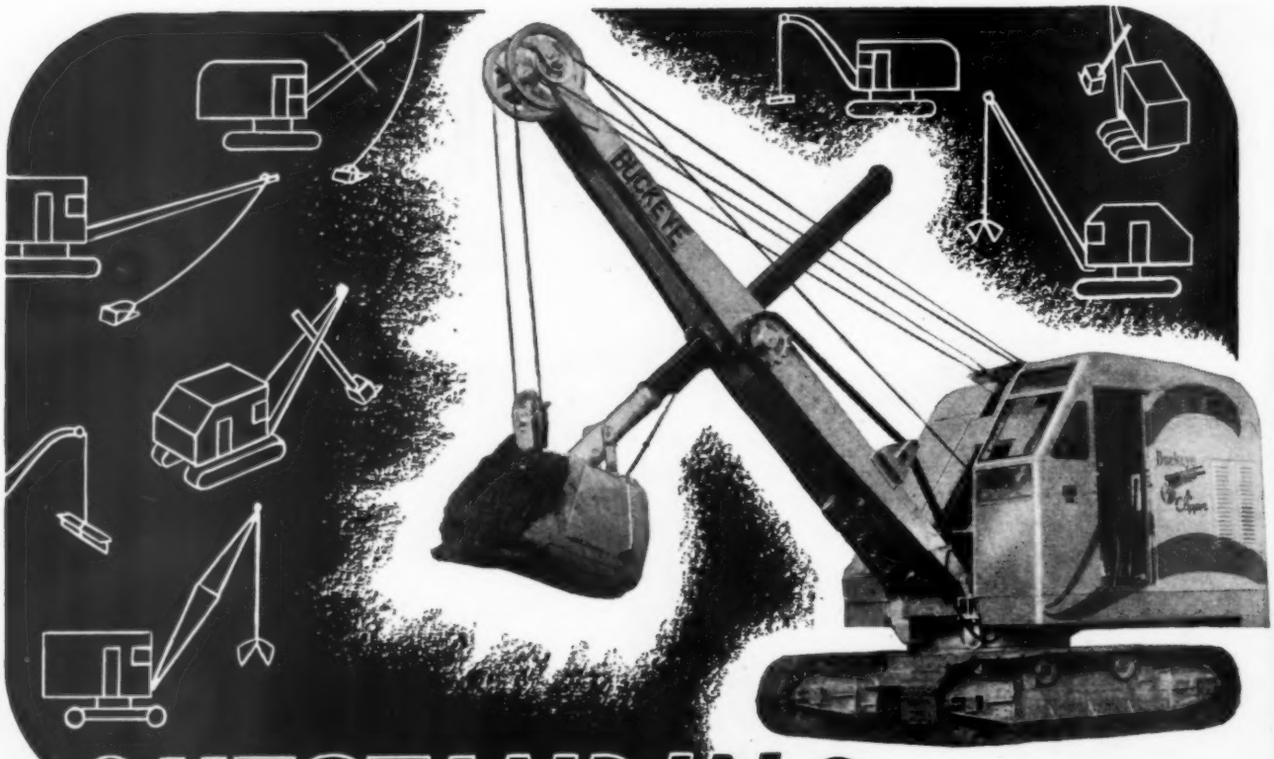
Light Weight—*No. 33 A 39-pound drill especially developed for mines, public utilities work and other uses where exceptionally powerful rotation is required. (steel retainer optional)*

Light Weight—*No. 38. A 44 pound, powerful, general purpose machine for medium drilling.*



Medium Weight—*No. 70 Series. 3 tools in the 55 pound class—powerful and fast for deep-hole drilling in hard rock.*

Heavy-Duty—*No. 85-B An 80 pound machine for deep drilling in the hardest kind of rock formations.*



OUTSTANDING IN ITS CLASS!

Buckeye Clipper ½ and ¾ yard convertible power shovels stand out in any comparison with other shovels of like size. They cut costs, handle smoother, dig faster, last longer.

CHECK THESE BUCKEYE CLIPPER FEATURES . . .

• "Mevac" Metered Vacuum Power Control, exclusive with Buckeye, gives operator better "feel"—makes brake and clutch linings wear longer—eliminates operator fatigue. • Automatic Swing Brake • 360° Swing • Non-Clogging, Self-Cleaning Crawlers • Automotive Type (Chainless) Drive • Independent, Positive, Chain Crowd • Even Weight Distribution • Crowd, Swing and Hoist While Traveling • Vacuum Power Control Dipper Trip

BUCKEYE DOZERS Are A Standout, Too

Buckeye Dozers and Trailbuilders are outstanding in their field, too! Ruggedly built to stand severe service, they are noted for fast, smooth operation. They dig in and push bigger pay loads with less tractor effort. See your Buckeye dealer for detailed information.

The Buckeye Clipper's 24 points of superior design and construction, that save time and cut costs, are detailed in "The Age of the Clippers." Send for your copy today and learn how these rugged, easy-to-operate, readily convertible shovels can increase your output and lower costs.

BUCKEYE TRACTION DITCHER CO.
Findlay, Ohio

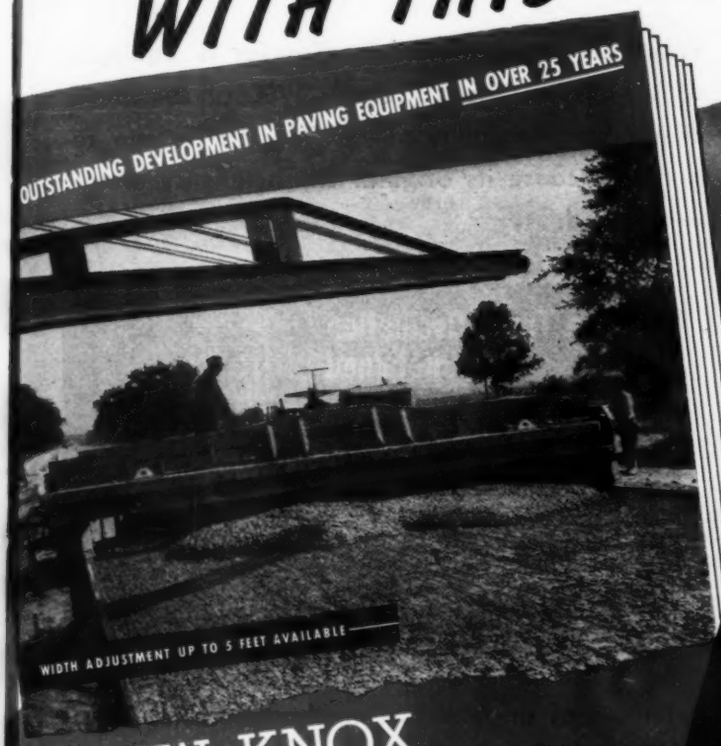
built by **Buckeye**

CONVERTIBLE SHOVELS—BULLDOZERS—ROAD WIDENERS
TRENCHERS—MATERIAL SPREADERS—R-B FINEGRADERS

GET BLUE RIBBON PRODUCTION WITH THIS PAVING TEAM

CONCRETE SPREADERS

FINISHING MACHINES


OUTSTANDING DEVELOPMENT IN PAVING EQUIPMENT IN OVER 25 YEARS
WIDTH ADJUSTMENT UP TO 5 FEET AVAILABLE
BLAW-KNOX
CONCRETE PAVING SPREADER
AUTOMATIC TRANSVERSE
FOR ROADS AND
BLAW-KNOX DIVISION, BLAW-KNOX COMPANY, PITT

ASK FOR THESE TWO BOOKS—THEY TELL THE WHOLE STORY

HERE— in print and ready for men interested getting jobs done fast—complete information about e finest paving combination you can put behind ving mixers.

Know all about

LAW-KNOX Transverse Blade CONCRETE SPREADERS
(Send for Catalog No. 2046)

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LAW-KNOX CONCRETE FINISHING MACHINES
(Send for Catalog No. 2045)

ese machines, and the complete line of Blaw-Knox Con- uction Equipment, are the answers to faster construction and ofitable paving.

ur nearest Blaw-Knox dealer knows the capacity of this uipment for **blue ribbon performance.** Ask him.

Representatives in Principal Cities

BLAW-KNOX
CONSTRUCTION EQUIPMENT

LAW-KNOX DIVISION OF BLAW-KNOX CO., 2003 Farmers Bank Bldg., Pittsburgh, Pa. • New York • Chicago • Philadelphia • Birmingham • Washington

CONCRETE BUCKETS | CLAMSHELL BUCKETS | STEEL STREET FORMS | PAVING FORMS FOR ROADS & AIRPORTS | AGGREGATE BATCHING PLANTS | TRUCK MIXER LOADING PLANTS | SHEEPSFOOT TAMPING ROLLERS | BULK CEMENT PLANTS

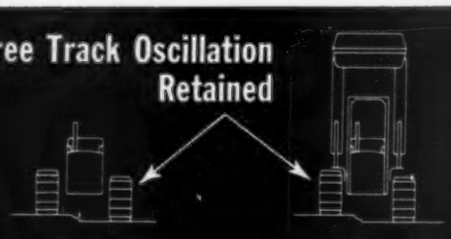
The Tractor is **Harnessed . . .** Not **Shackled**

When an International TracTracTor is equipped with a Bucyrus-Erie DOZER-SHOVEL, all the speed, power and flexibility of the TracTracTor are retained because its original characteristics remain unchanged:

No Radical "Balance Upset"

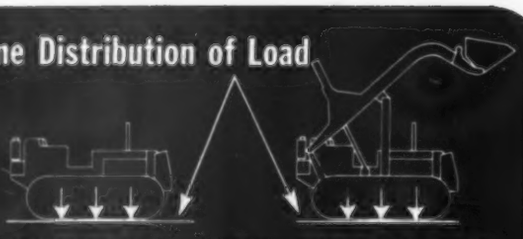
Almost exactly the same center of gravity as that found on the TracTracTor alone is maintained. The effective traction and stability of the bare tractor are retained. There is no loss of power, no excessive wear, no loss of the efficiency originally built into the tractor.

Free Track Oscillation Retained



With the DOZER-SHOVEL mounted to the TracTracTor, the full free track oscillation of the bare tractor is retained to give you the maximum track-to-ground contact that means so much to tractive effort and to stability.

Same Distribution of Load



The DOZER-SHOVEL is so perfectly matched to the tractor that together they form a combination unit which maintains the same uniform distribution of weight over the ground-contact shoes as that found on the bare TracTracTor. While total weight is, of course, increased, distribution of the extra weight is exactly the same as the distribution of the tractor's weight.

Retention of original tractor characteristics is just one of the many reasons why the versatile DOZER-SHOVEL (for T6, TD6, T9, and TD9 TracTracTors) is UNIQUE among front-end loaders. Let your International TracTracTor Distributor tell you about some of the other reasons, too: three-way service,* full front visibility, low overhead clearance, positive down pressure, simple rugged design, easy interchangeability.

* shovel — bulldozer — crane

17T45

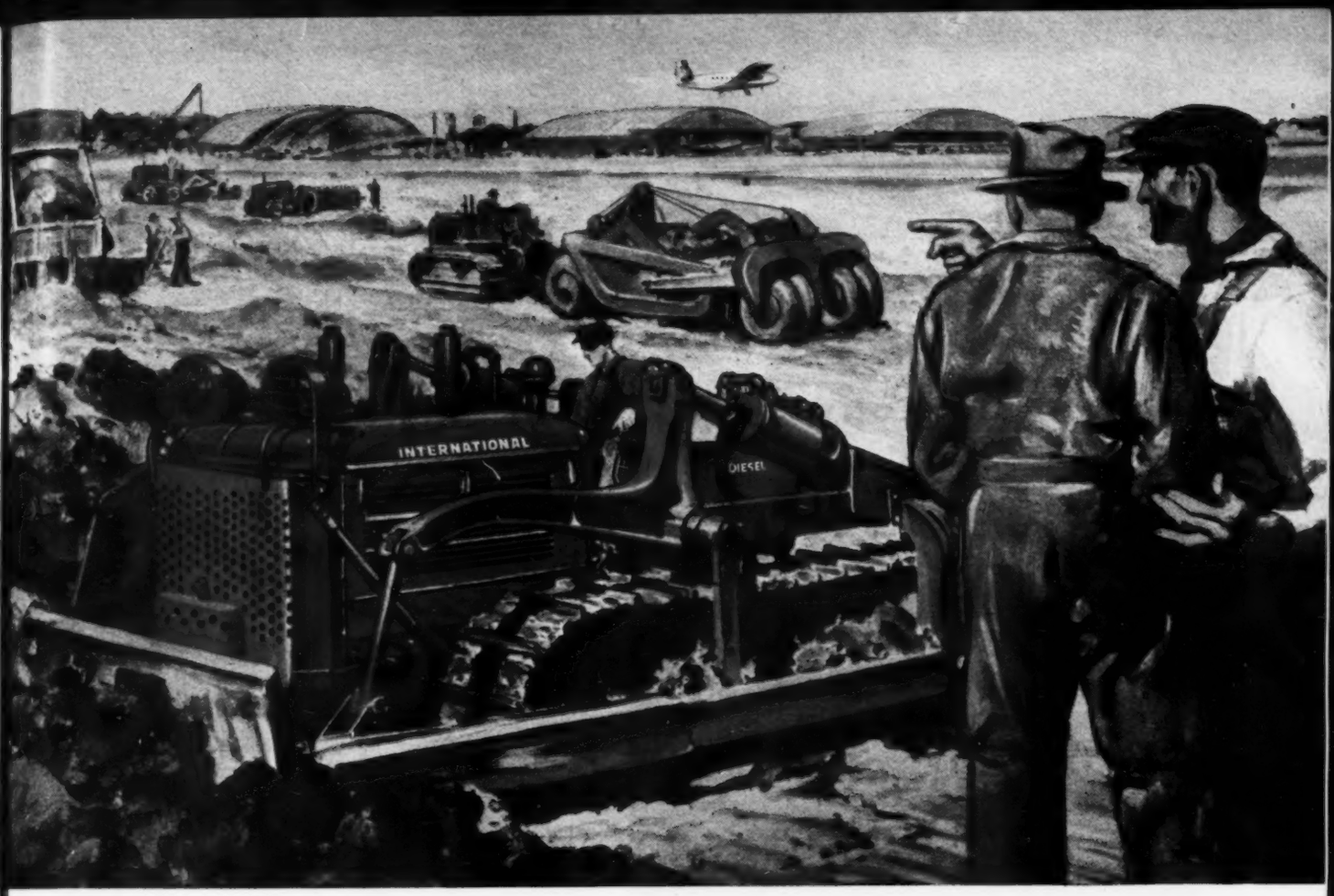
BUCYRUS ERIE

SOUTH MILWAUKEE, WISCONSIN

See Your

INTERNATIONAL TRACTRACTOR

Distributor



Speed Up Your Work Schedule with INTERNATIONALS

• That means you make more money, if you've figured right. And you figured right if you put International Tractors and International-powered equipment on the job. There's nothing that can beat them, size for size, in dirt moving, construction and maintenance work.

International Tractors keep moving—forever digging into the work laid out for them—at rock-bottom cost. They keep moving because they're rugged enough for the most punishing kind of work—because they're powered by International heavy-duty Diesel engines.

These great machines have the bulldog hang-on you want when cutting and filling with 'dozers, rippers or scrapers. They have the weight distribution and ratio of horsepower to weight that means sure-footed traction and mastery of any terrain.

Be sure to check with the International Industrial Power Distributor near you on the many advantages which International Trac-TracTors, Wheel Tractors and International-powered equipment have to offer.

The large number of manufacturers who build equipment expressly for International Tractors and Engines shows an acceptance where acceptance really counts!

INTERNATIONAL HARVESTER

Industrial Power Division
INTERNATIONAL HARVESTER COMPANY
180 North Michigan Avenue Chicago 1, Illinois

INTERNATIONAL Industrial Power

Commissioned

FOR ALL FRONT-LINE SERVICE

THE General
TYPE 10 - MODEL 105

•

THE ORIGINAL
"MACHINE OF TOMORROW"

ONE MAN
ONE ENGINE
ON RUBBER

General Ironguts is proud to commission this newest General for duty on the construction, excavating and materials handling "fronts." Built by General—the company that pioneered the one-man, one-engine, rubber-tired Supercrane five years ago—this latest General is another "first" that takes its place as a leader in the construction machinery field.

ALL-IN-ONE. The General Type 10, Model 105 is a combination unit that will turn in profits on any job. Shovel, crane, backhoe, dragline, magnet or pile driver . . . you name the job, then watch this amazing machine do the work faster, better and cheaper!

ONE-MAN, ONE-ENGINE. Positive acting, simple controls plus a single heavy-duty engine—that's the reason for the smooth, efficient performance that comes natural to the Type 10. Swing, travel, boom—operated simultaneously or independently—every function is performed with clock-like precision that cuts working time to a minimum!

AND ALL THIS. Fast highway travel (more than 20 mph) with absolute safety, air booster steering, optional four-wheel drive, heavy duty clutches and transmission, 4 speeds forward, 4 speeds reverse, easy, quick changeover of attachments . . . mobility and ease of operation that get the most difficult jobs done in record time! Conforms to all highway regulations and in most states needs no permit to travel over the roads.

WRITE TODAY!

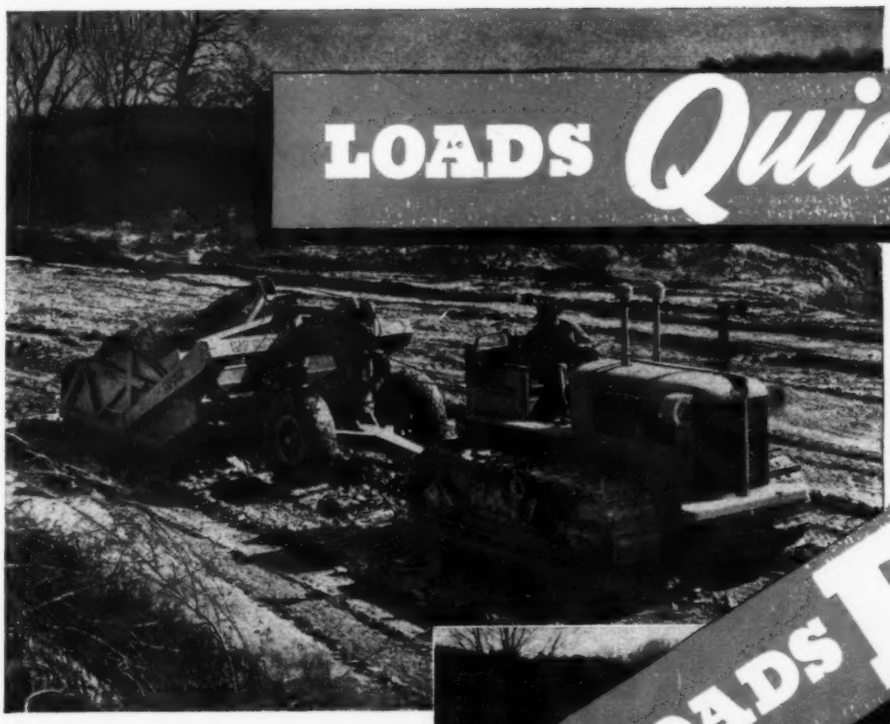
The complete story of this profit-making, versatile rig is of vital interest to every man interested in construction, excavating or materials handling. Ask your nearest distributor for your free copy of the General Type 10, Model 105 specifications, or write **THE GENERAL EXCAVATOR CO., MARION, O.**

Associated with The Osgood Company

THE OSGOOD COMPANY
SHOVELS, DRAGLINES
CRANES
CRAWLER & WHEEL MOUNTS
DIESEL, OIL, GAS, ELECTRIC

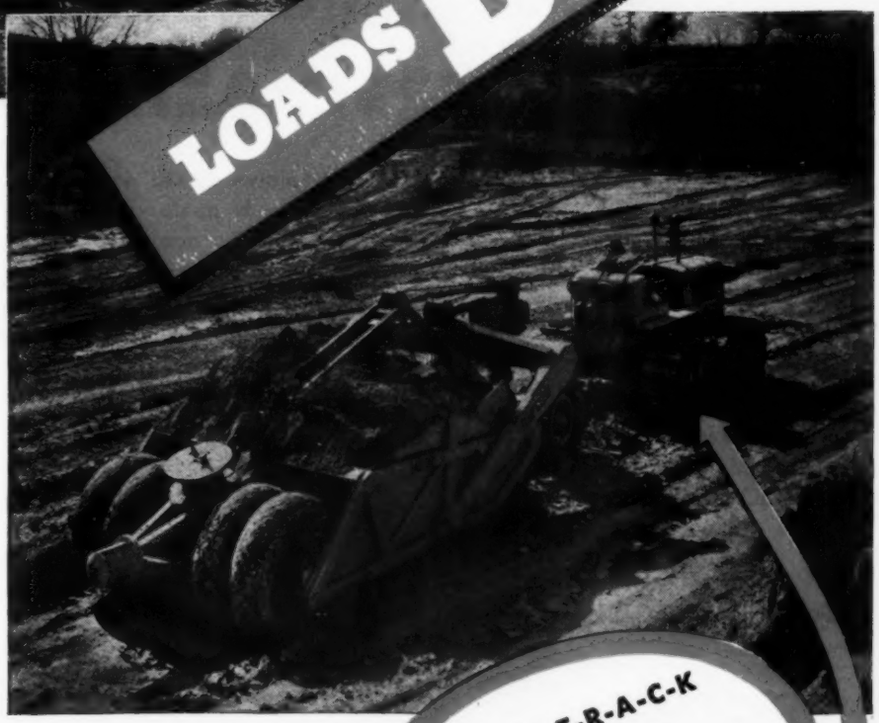
GENERAL EXCAVATOR CO.
CRANES-SHOVELS MARION OHIO U.S.A. GENERAL OSGOOD
MARION, OHIO

CRANES, DRAGLINES AND SHOVELS



LOADS *Quick* . . .

LOADS BIG!



PROPERLY BALANCED HD-10 INCREASES YARDAGE MOVED

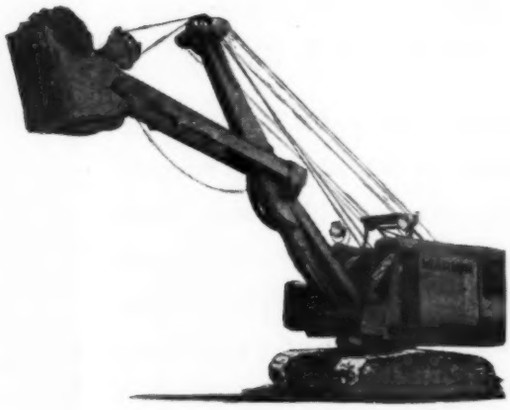
There's more dirt on the move with an HD-10 on the scraper. You can get big loads quick with this properly balanced tractor. There's sure traction with the long tracks and heavy truck frame . . . operation is steady, smooth. These features plus addition of an extra heavy front spring makes it ideal, too, for operating front or engine mounted equipment.

Whatever the job — scraper work, bulldozing or hauling . . . you will get more done at less cost with the HD-10. Whatever the soil condition . . . this ground-gripping tractor will give you better footing. It will pay you to get all the facts from your Allis-Chalmers dealer.

L-O-N-G T-R-A-C-K
Gives you:
IMPROVED TRACTION
IMPROVED BALANCE
IMPROVED RIDING
IMPROVED PERFORMANCE!

ALLIS-CHALMERS

TRACTOR DIVISION • • MILWAUKEE 1, U. S. A.



There are still a few open spaces on the

MARION

schedule for some sizes of Shovels ★ Draglines ★ Clamshells Cranes ★ Pull-shovels

What size or type machine do You need?

THE MARION STEAM SHOVEL CO., MARION OHIO

FWD *Snow-Bank Busting* POWER
CONQUERS HEAVIEST DRIFTS

● FWDs are the snow-clearing trucks that can bust in and break the worst snow banks — clean them up fast, economically! Sure-footed traction and power on all four wheels make FWDs the No. 1 snow removal and road maintainance trucks of the nation. Thousands of these rugged, heavy-duty trucks, equipped with many different types of snow plows, will deliver the knockout punch to snow in every state in the snowbelt this year, and remove the menace of snowbound highways, streets, airports and other areas where snow must be put out of the way.

When Spring comes, these same rugged snow-fighting trucks will have their plows removed, to change over to the many other tough road jobs which only four-wheel-drive power and traction can match. One truck for ALL jobs, ALL seasons . . . that's the FWD!

THE FOUR WHEEL DRIVE AUTO COMPANY, Clintonville, Wis.

Canadian Factory: KITCHENER, ONTARIO

FWD TRUCKS

THE ORIGINAL EXCLUSIVE BUILDERS OF FOUR-WHEEL-DRIVE TRUCKS

THE ONE TRUCK FOR MANY JOBS

SPRING — Road conditioning and construction.
SUMMER — Earth-moving. Material hauling.
FALL — Road patrolling. Snow fence hauling.
WINTER — Snow clearing.

Gar Wood Cable Dozecaster

Gar Wood 2-Wheel Hydraulic Scraper

Gar Wood 4-Wheel Cable Scraper

GAR WOOD ROAD MACHINERY

WITH ALLIS-CHALMERS DIESEL POWER

up GOES YARDAGE

down GO COSTS

Gar Wood earth moving units boost yardage to a maximum by superior maneuverability, ease of control and advanced design.

They push down costs by their high efficiency on the job and by staying on the job.

"Teamed-up" with Allis-Chalmers 2-cycle Diesel Tractors, they have the power to get jobs done most economically and quickly. Service is always promptly available.

These are some of the reasons for the increasing demand for Gar Wood Road Machinery, now the greatest by far in Gar Wood history—demand that has reached the proportions of a nationwide trend. Get the Gar Wood units that will push your yardage up and your costs down from your Allis-Chalmers dealer.

Down goes a 60-foot-high tree to the irresistible push of a Gar Wood Hydraulic Bulldozer

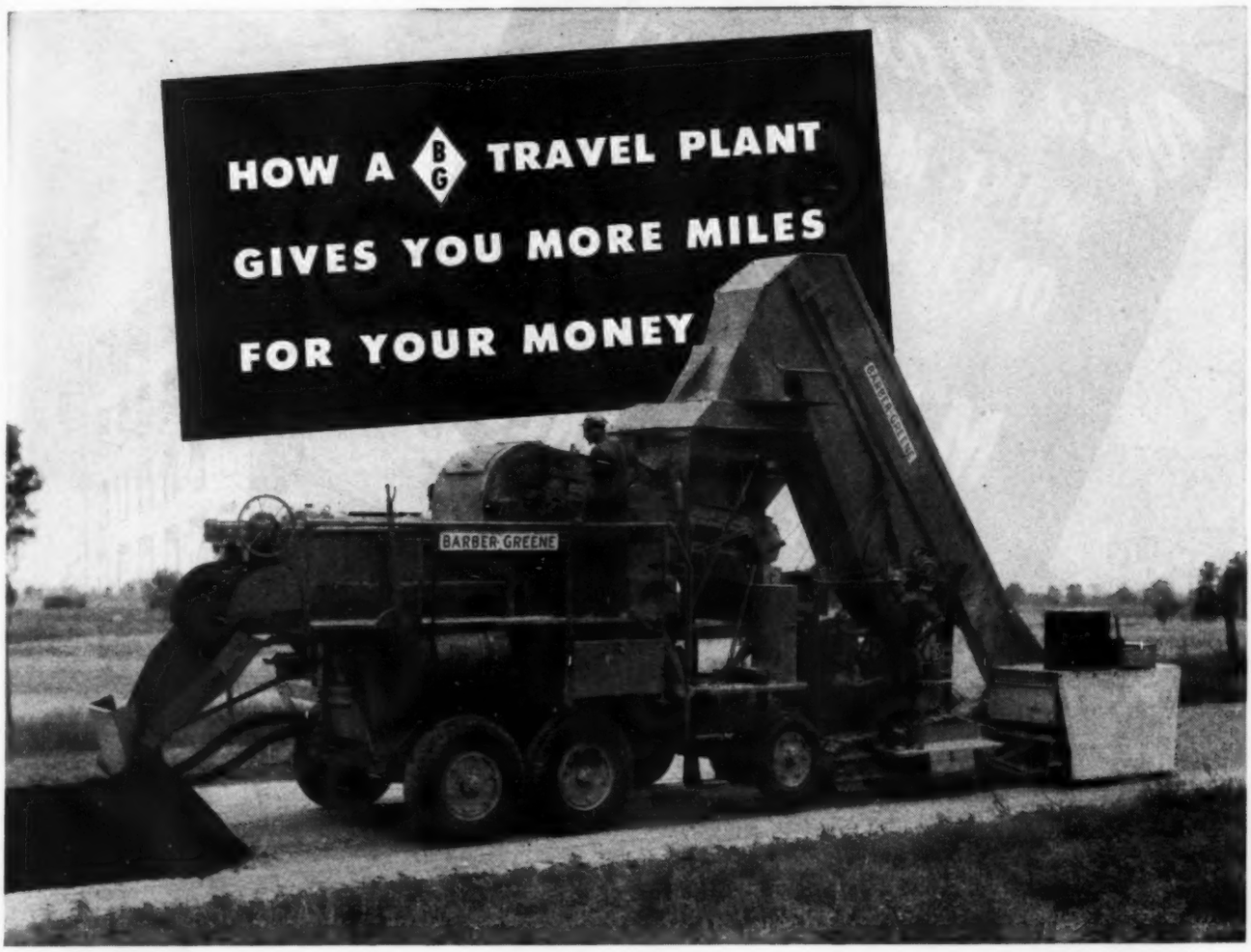
GW ROAD MACHINERY is Sold Through ALLIS-CHALMERS Dealers Everywhere

ROAD MACHINERY DIVISION

GAR WOOD INDUSTRIES, Inc.

DETROIT 11, MICHIGAN

OTHER PRODUCTS OF GAR WOOD INDUSTRIES INCLUDE HOISTS AND BODIES • WINCHES AND CRANES • TANKS • HEATING EQUIPMENT • MOTOR BOATS



● Building longer lasting asphalt roads is only *one* of the ways a Barber-Greene Travel Plant gives you more for your money.

Here's how a B-G Travel Plant cuts down construction expense to help you stretch limited funds into more miles of completed highways:

*** Continuous, high quality production. No batches, no pauses. No human element to lower capacity . . . no dependence on operating skill to maintain consistency.**

*** Reduction of the weather hazard. No partially-prepared material to be spoiled by sudden showers.**

*** Full working periods. Short mixing cycle permits operation on colder days, later at night, earlier and longer in the season.**

*** No sacrifice of bitumen quality to allow for time-consuming blading. No rich or lean spots. Lower percentages of heavier and quicker-setting bitumen with less solvent produce uniformly-coated mixes.**

*** Easy job coordination. Mixing and proportioning performed by a single unit under control of two or three men. When aggregate is windrowed well ahead, it's automatically available as needed.**

*** Low investment. Cost of the B-G Travel Plant is no more than that of the necessary machines for mixed-in-place construction of the same mileage.**

*** Versatility. Handles all types of bituminous and stabilized work. Can be centrally located for maintenance requirements . . . becomes an integral part of Central Plant set-up for production of high-type mixes.**

Write for catalogs describing how the economical operation of B-G equipment enables you to surface roads with plant-mixed material at blade-mix cost. Barber-Greene Company, Aurora, Illinois.

45-9

Barber-Greene B G *Constant Flow Equipment*

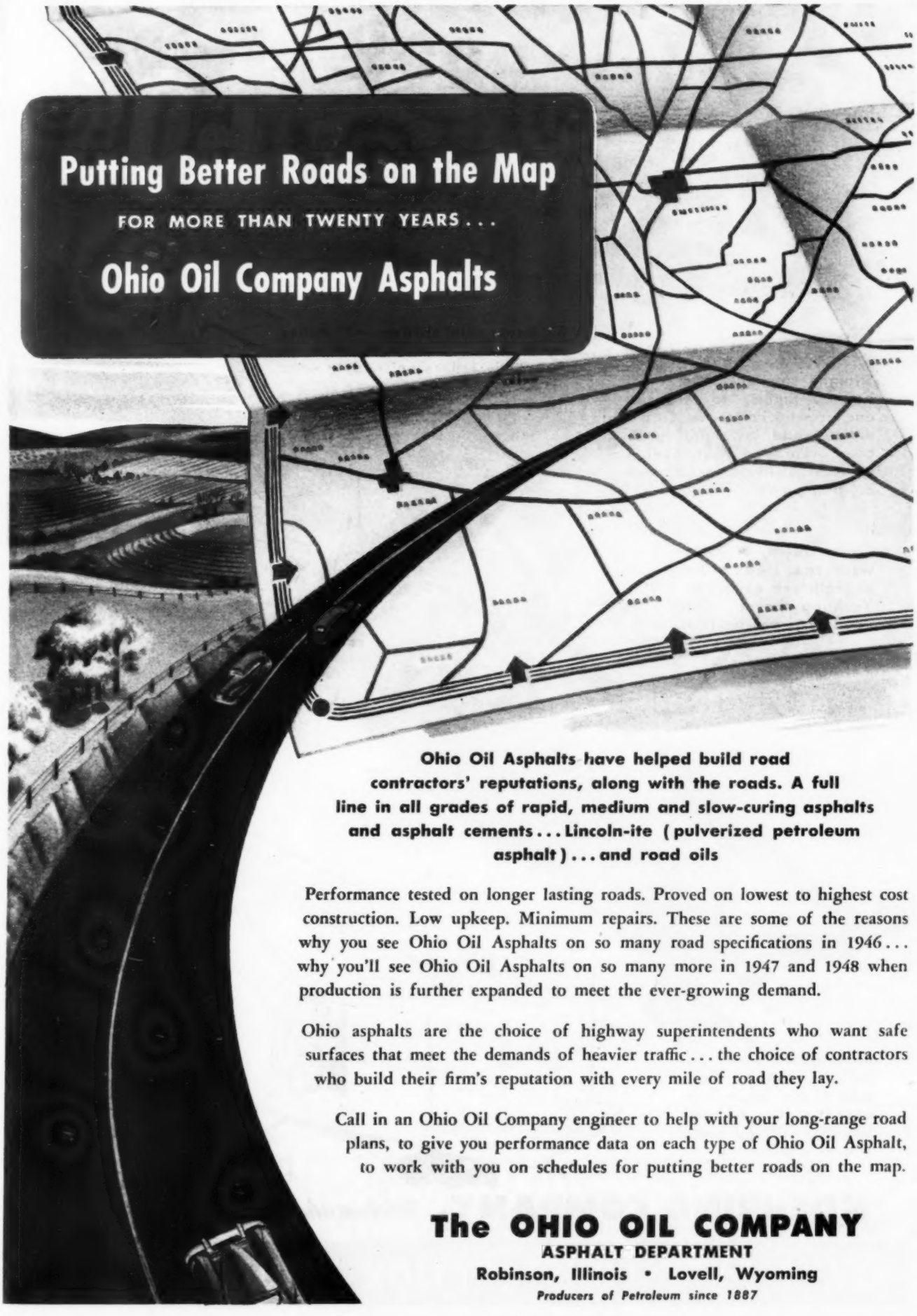
You Can MAKE MORE MONEY ON JOBS LIKE THIS with MICHIGAN mobile SHOVELS–CRANES!

Here's Why: **TRUCK MOBILITY cuts travel-time between jobs. No trailer or tow-truck required. QUICK CONVERTIBILITY means change-overs made in two hours or less—and one MICHIGAN handles five types of work—shovel, crane, clamshell, dragline, trench hoe. FINGERTIP AIR CONTROLS step up hourly output, get the job done faster, minimize operator fatigue! . . . But get *all* the facts about these profit-earning MICHIGANS —⅜ and ½ yard capacities, 6 to 12 ton cranes. Write for your copy of MICHIGAN Bulletin RS-26.**

MODEL
T-6-K
⅜ YD. SHOVEL
6 TON CRANE

ARMY E NAVY

MICHIGAN
POWER SHOVEL COMPANY
BENTON HARBOR, MICHIGAN



Ohio Oil Asphalts have helped build road contractors' reputations, along with the roads. A full line in all grades of rapid, medium and slow-curing asphalts and asphalt cements . . . Lincoln-ite (pulverized petroleum asphalt) . . . and road oils

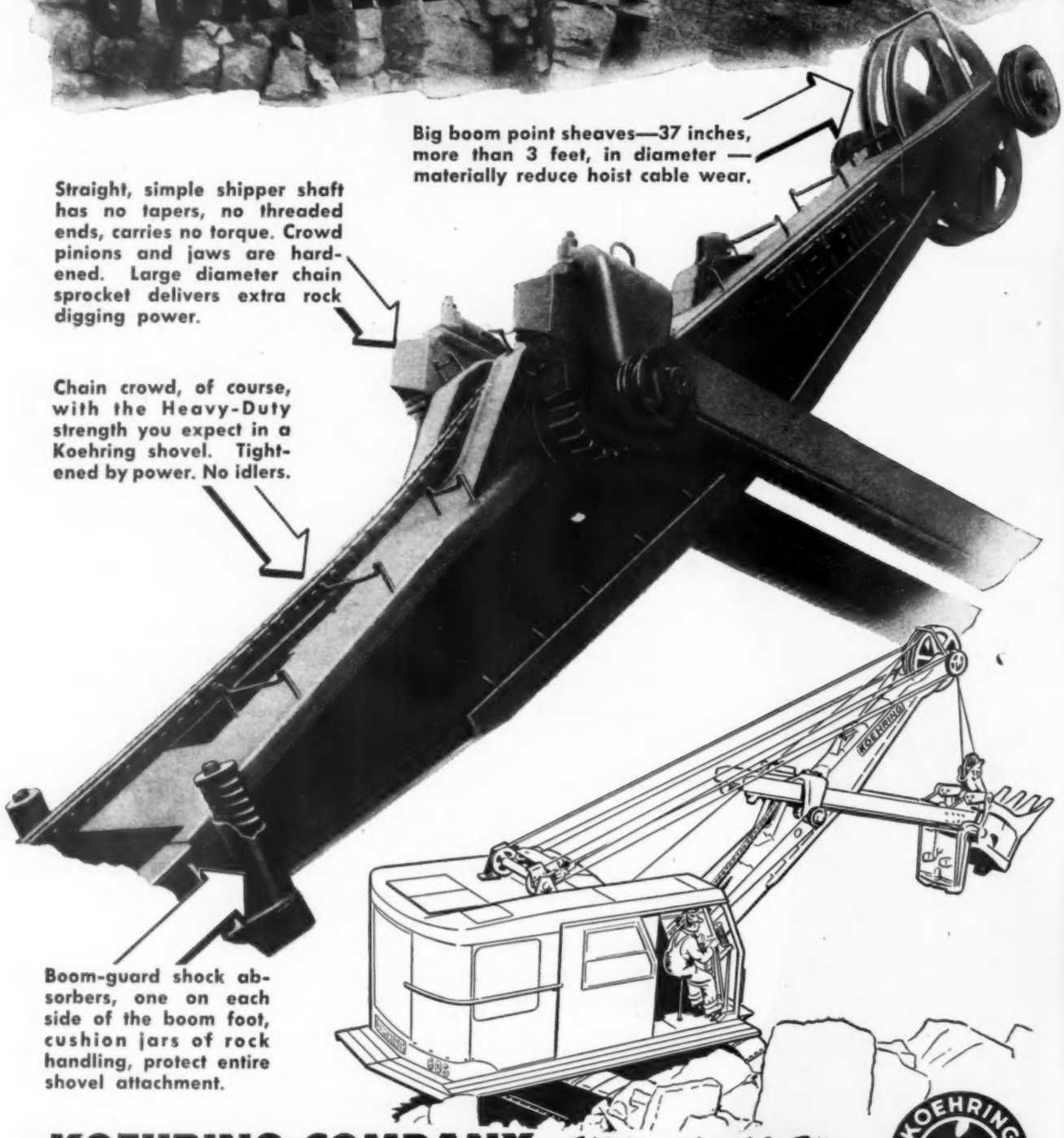
Performance tested on longer lasting roads. Proved on lowest to highest cost construction. Low upkeep. Minimum repairs. These are some of the reasons why you see Ohio Oil Asphalts on so many road specifications in 1946 . . . why you'll see Ohio Oil Asphalts on so many more in 1947 and 1948 when production is further expanded to meet the ever-growing demand.

Ohio asphalts are the choice of highway superintendents who want safe surfaces that meet the demands of heavier traffic . . . the choice of contractors who build their firm's reputation with every mile of road they lay.

Call in an Ohio Oil Company engineer to help with your long-range road plans, to give you performance data on each type of Ohio Oil Asphalt, to work with you on schedules for putting better roads on the map.

The OHIO OIL COMPANY
ASPHALT DEPARTMENT
Robinson, Illinois • Lovell, Wyoming
Producers of Petroleum since 1887

KOEHRING STOVE BOOM QUARRY-DUTY 605



Big boom point sheaves—37 inches, more than 3 feet, in diameter — materially reduce hoist cable wear.

Straight, simple shipper shaft has no tapers, no threaded ends, carries no torque. Crowd pinions and jaws are hardened. Large diameter chain sprocket delivers extra rock digging power.

Chain crowd, of course, with the Heavy-Duty strength you expect in a Koehring shovel. Tightened by power. No idlers.

Boom-guard shock absorbers, one on each side of the boom foot, cushion jars of rock handling, protect entire shovel attachment.

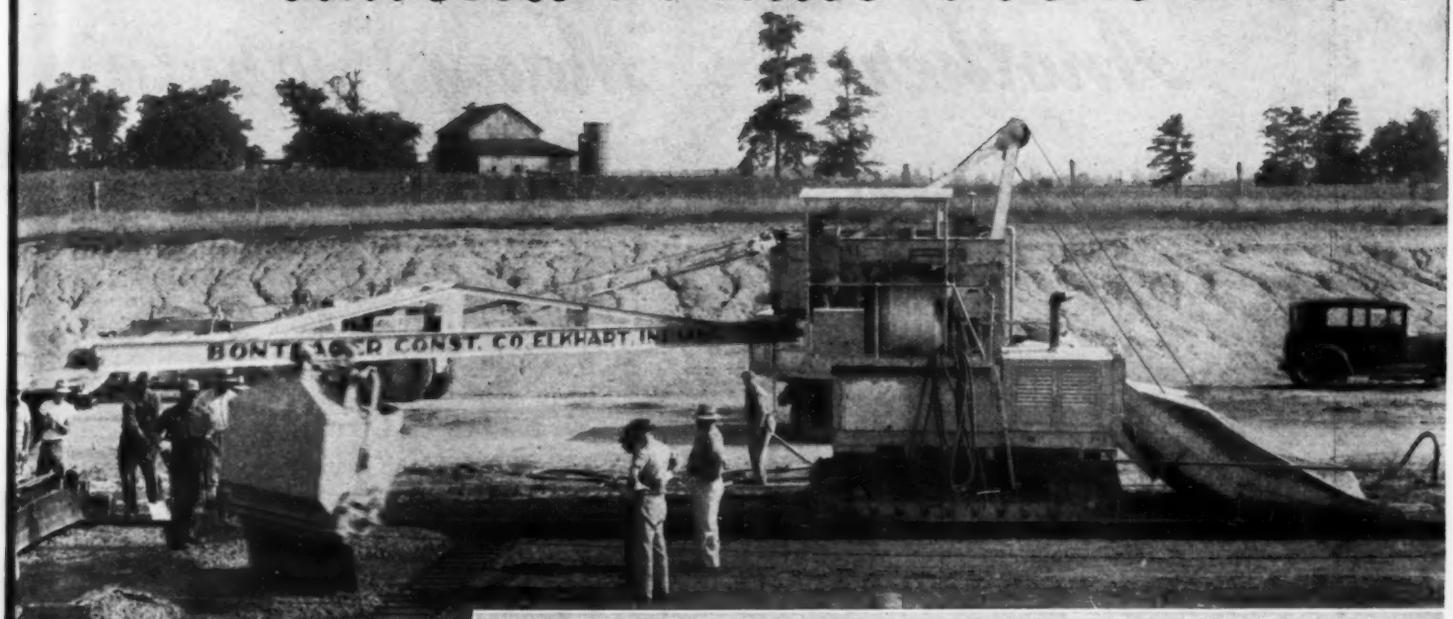
KOEHRING COMPANY, *Milwaukee 10, Wis.*

KOEHRING HEAVY DUTY

HEAVY-DUTY CONSTRUCTION EQUIPMENT

THIS MULTIFOOTE 34-E

traveled 120 miles in one season

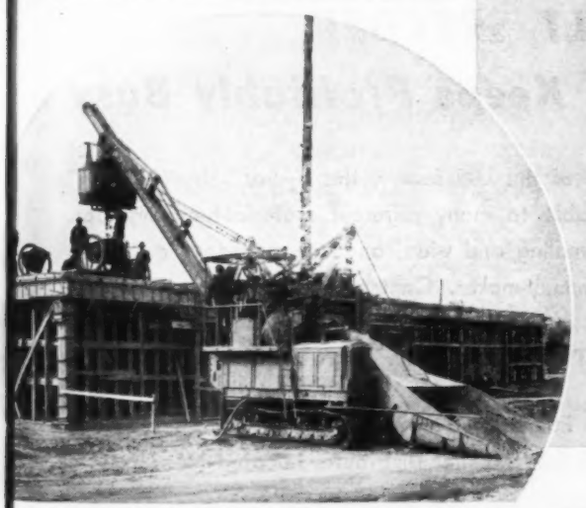


120 Miles traveled during the 1945 season! That's the record hung up by one of the MultiFoote 34-E's owned by the Bontrager Construction Company, Elkhart, Indiana.

Think what 120 miles traveled on paving jobs means in terms of paver dependability and profit possibilities on your contracts! This is *working* mileage with a machine that can handle the heaviest paving schedules, season after season, at lowest operating and maintenance costs and without expensive delays for overhaul and repairs.

Let's take a closer look at the rugged, simple Multi-Foote traveling mechanism: The drive is from the single, special chrome molybdenum steel main shaft. Gears are fully enclosed and run in oil... giving two speeds—forward and reverse. Crawlers are long and wide for low ground bearing pressure, and are tapered at discharge end for plenty of bucket clearance when boom is swung. Crawler rollers are solid chilled steel—on 3-inch, high-carbon steel shafts that are mounted directly in the crawler side frame to provide maximum strength and simplicity. Extra-strength treads wear longer, will not "dish in."

Add the many other MultiFoote advantages that have put more of them on the world's jobs than any other paver, and you have the ideal machine for a big-profit 1946. Call or write your MultiFoote distributor for complete information.



THE FOOTE COMPANY, Inc., 1936 State St., Nunda, N. Y.

MultiFoote Elevating Boom

With the MultiFoote Elevating Boom, you can put full loads 18 feet above ground level—get those building and construction jobs that mean extra profits with your MultiFoote 34-E.

ARMY (E) NAVY

Three Army-Navy "E" Awards for The Foote Company!

MULTIFOOTE

CONCRETE PAVERS

LINK-BELT SPEEDER LS-50

Another "Many Purpose" Machine!

DRAGLINE

CLAMSHELL

TRENCH HOE

SHOVEL

All illustrations of LS-50. Other models up to 3-yd.

FIRST ON THE JOB— LAST TO LEAVE— LINK-BELT SPEEDER Keeps Profitably Busy

Like all members of the LBS family, this ½-yd. "Shovel-Crane" is readily adaptable to many different material-handling jobs.

Power, easy handling and wide range of usefulness, make this machine a real money-maker. Contractors and highway departments in all parts of the country will find it advantageous to consider a LINK-BELT SPEEDER in their future plans!

For Prompt, Efficient, Convenient Sales and Service: There is a Link-Belt Speeder Distributor Located Near You

10,201

LINK-BELT SPEEDER

Builders of the Most Complete Line of **SHOVELS-CRANES-DRAGLINES**

LINK-BELT SPEEDER CORPORATION, 301 W. PERSHING ROAD, CHICAGO 9, ILL.
A DIVISION OF LINK-BELT COMPANY

If you needed

A MILLION DOLLARS

COULD YOU RAISE IT IN LESS THAN 30 MINUTES?

A contracting firm had bid successfully on a large construction job. They realized that yesterday's methods would not meet today's needs . . . new equipment would be needed to handle the job . . . and the investment would total over a million dollars.

This well-financed company decided that it would be an advantage to borrow this money and amortize the loan over many months . . . let the new equipment pay for itself . . . leave their working capital unimpaired for supplies, payrolls, operating.

The details were laid before C.I.T. and . . . IN LESS THAN THIRTY MINUTES all arrangements were completed for a loan of over a million dollars! Of course it isn't always possible, under all circumstances, to arrange a loan in such a short time. However, the celerity with which this transaction was handled is typical of C.I.T. business methods.

This case history is not unusual. C.I.T. has made similar loans to industry . . . often on short notice . . . with repayment terms which retire the obligation over periods of months or years. C.I.T. is prepared to arrange financing in large or small amounts to fit the needs of almost any business.

HERE'S HOW C.I.T. GRANTED SUCH A REQUEST . . . AND IN LESS THAN HALF AN HOUR!

Any sound business can readily obtain working capital from C.I.T. Thousands or millions, AT LOW COST, and with a minimum of negotiation. Industry is invited to use our resources as an aid to better business.

Write, wire or call any of these offices for information

OFFICES:

ONE PARK AVENUE,
NEW YORK, N. Y.

333 N. Michigan Avenue
CHICAGO, ILL.

660 Market Street
SAN FRANCISCO, CALIF.

In Canada:
CANADIAN ACCEPTANCE CORPORATION *Limited*
Metropolitan Building, Toronto

The Mark of LEADERSHIP

C.I.T. CORPORATION

INDUSTRIAL FINANCING

AFFILIATED WITH COMMERCIAL INVESTMENT TRUST INCORPORATED

LIMA

FOR OVER 75 YEARS A MARK OF QUALITY

1946

LIMA

LIMA LOCOMOTIVE WORKS INCORPORATED
SHOVEL AND CRANE DIVISION, LIMA, OHIO

SHOVELS - CRANES - DRAGLINES

Capacities

SHOVELS
¾ Yd. to 5 Yds.

CRANES
13 Tons to 100 Tons

DRAGLINES
Variable

HYSTER

Rugged
TRACTOR EQUIPMENT for your "CATERPILLAR" TRACK-TYPE TRACTOR

HYSTER tractor equipment is quality all the way through. Sound engineering. Rugged construction. Long life.

Hyster line is made for use with "Caterpillar" track-type tractors. Models include winches, donkeys, yarders, cranes, sulkies, logging arches.

Hyster Company has specialized in "Caterpillar" equipment for 16 years and is the world's largest maker of tractor winches.

The proving ground for Hyster equipment—as for "Caterpillars"—has been the tough towing, lifting and moving jobs around the globe. Long experience with the requirements of construction men in every country accounts for the heavy-duty service of the "Caterpillar"-Hyster combination.

Hyster tractor equipment is sold and serviced by more than 300 "Caterpillar" distributors and dealers throughout the world. One of them is near you. Ask him about Hyster models that will help in your work —or write direct for literature.

PIONEERS IN MATERIALS HANDLING EQUIPMENT

Extra power... extra pull. "Caterpillar" D7 equipped with a Hyster double drum Tractor Donkey.

HYSTER COMPANY

2995 N.E. CLACKAMAS STREET
PORTLAND 8, OREGON

1895 NORTH ADAMS STREET
PEORIA 1, ILLINOIS

★

● World's largest manufacturer of Tractor Winches. Builders of Hyster Industrial Trucks. Service Offices in principal world cities.

AMERICA NEEDS ITS FASTEST TOOLS

Now!

. . .Tools like Barco Portable Hammers that have proved their efficiency and economy. Reports from every field of industry show owners' enthusiasm for the ready adaptability of this rugged, many-purpose tool. Barco Portable Gasoline Hammers are powered with air-cooled, two cycle, single cylinder engines. Put Barcos on your job for more speed. Don't hesitate to ask for full details.

BARCO

Portable Gasoline HAMMERS

BREAKING

TAMPING

DRILLING

DRIVING

DIGGING

FREE ENTERPRISE—THE CORNERSTONE OF AMERICAN PROSPERITY

BARCO MANUFACTURING COMPANY, NOT INC., 1815 Winnemac Ave., Chicago 40, Ill. • In Canada: The Holden Co., Ltd., Montreal, Can.

An optical comparator used to check gear thread profiles in the OLIVER "Cletrac" plant.

Check . . . and double check

It's fundamental at Oliver "Cletrac" . . . the checking and double checking of all tractor parts before they are assembled. The most modern of testing and checking devices are in daily use as typified by this operator checking the thread profile of a gear.

The thread, magnified 62½ times, is projected on the screen where minor and major diameters, including angle and lead, can be checked within .0001. Use of precision equipment such as this guarantees that nothing is left to chance in building Oliver "Cletracs."

Quality is the standard that characterizes every tractor part . . . in design, workmanship, materials and performance.

Maintenance of that standard enables your Oliver "Cletrac" dealer to offer you the finest in crawler tractors . . . for your every need.

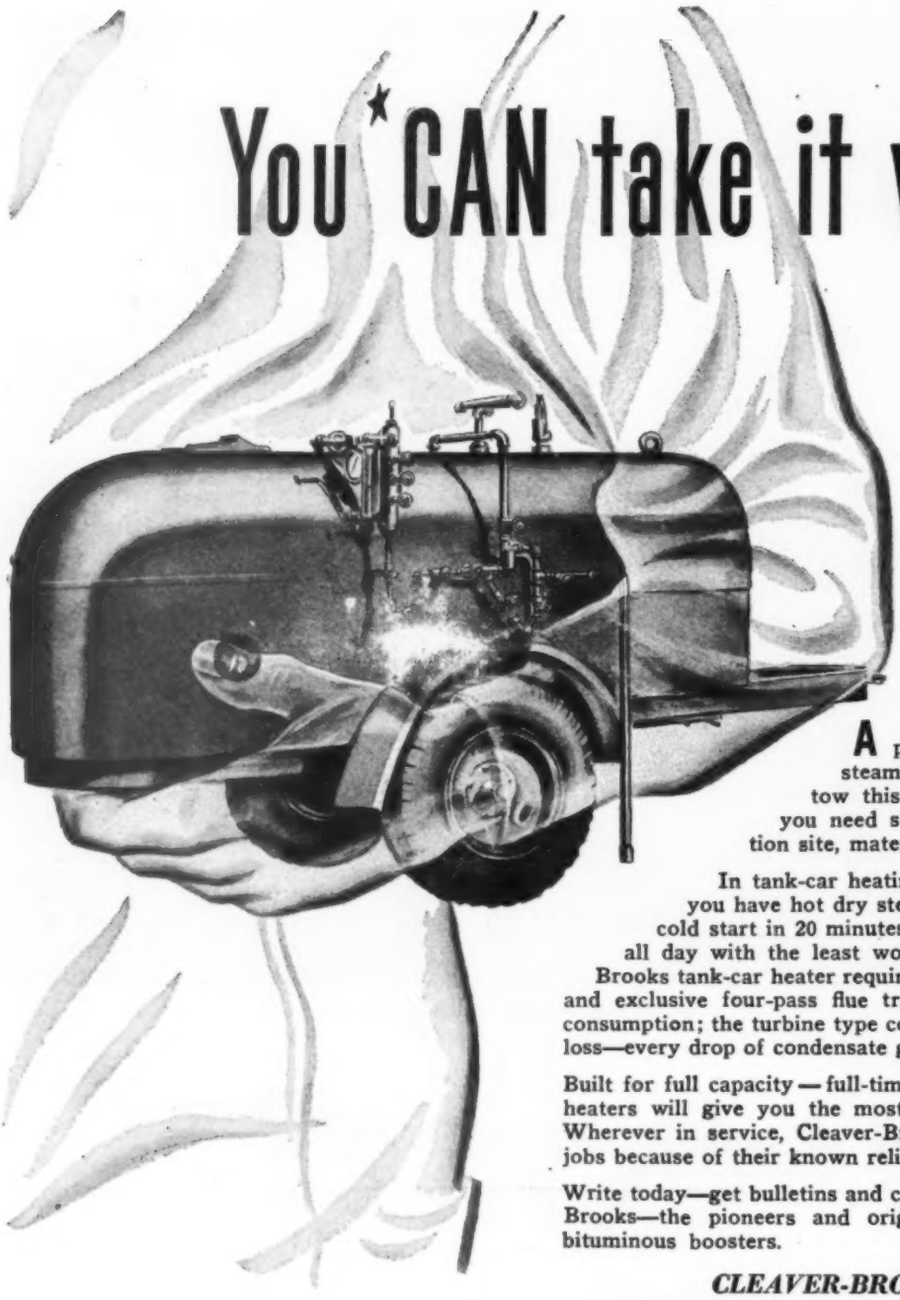
CLETRAC

a product of

The OLIVER Corporation

You CAN take it with you ..

wherever you need *Steam!*



A perfected, highly efficient portable steam generator — on wheels — you can tow this unit with car or truck anywhere you need steam — tank-car siding, construction site, material yard or other location.

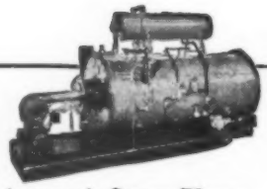
In tank-car heating with the Cleaver-Brooks heater you have hot dry steam flowing to the car coils from a cold start in 20 minutes or less. And you can keep going all day with the least work and bother because a Cleaver-Brooks tank-car heater requires less fuel and water. The famous and exclusive four-pass flue travel construction means low fuel consumption; the turbine type condensate return system cuts water loss—every drop of condensate goes back to heater under pressure.

Built for full capacity — full-time work — Cleaver-Brooks tank-car heaters will give you the most in production hours on the job. Wherever in service, Cleaver-Brooks are usually given the tough jobs because of their known reliability.

Write today—get bulletins and complete information from Cleaver-Brooks—the pioneers and originators of tank-car heaters and bituminous boosters.

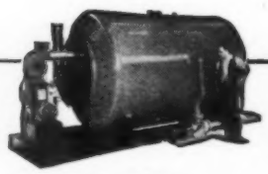
CLEAVER-BROOKS COMPANY

329 E. Keefe Ave. • Milwaukee 12, Wisconsin



Automatic Steam Plants

Completely self contained; highly efficient; require only simple piping connections to place in operation. Fully automatic fuel-oil burner; condensate recovery and feed water pumping system; no stack needed, sizes from 20 to 500 h.p.; pressures 15 to 200 lbs.

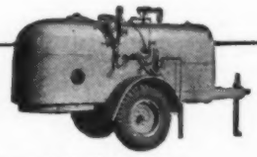


Hot Water Boosters

Oil-fired; fully automatic or manual operation; no licensed engineer needed; two capacity sizes: 3000 gals. storage tank for 1600 gals. of water heated 150° F. per hour; 1500 gals. storage tank for 800 gals. of water heated 150° F. per hour.

Portable Pumping Boosters

Heats bituminous material by direct firing in one operation, loading directly to distributor, relay truck or returning to tank car. Two sizes, truck mounting or 4-wheel trailer.



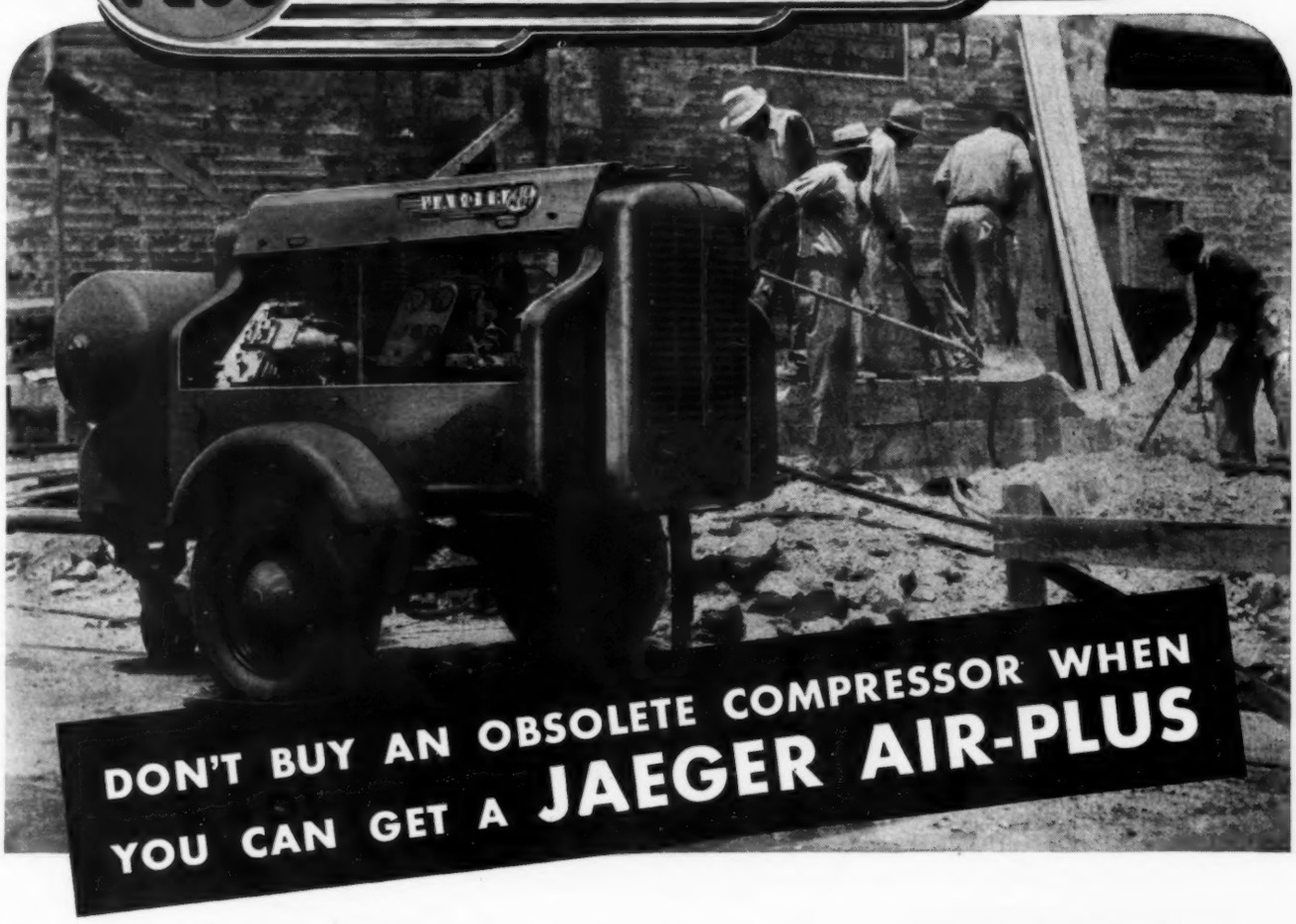
Portable Tank-Car Heaters

Available in 2 and 3 tank-car sizes. Oil-fired with exclusive four-pass flue travel; dry-coil steam condensate return under pressure — no water or heat loss. Provides a portable source of steam wherever needed.

Cleaver-Brooks

Pioneers and Originators of ★TANK CAR HEATERS ★BITUMINOUS BOOSTERS ★AUTOMATIC STEAM-PLANTS

AIR PLUS JAEGER COMPRESSOR



DON'T BUY AN OBSOLETE COMPRESSOR WHEN YOU CAN GET A JAEGER AIR-PLUS

There's at least 5 YEARS' DIFFERENCE between ordinary air compressors and the modern Jaeger "AIR PLUS". . . . Engineered as complete units to micro-precision standards unknown before the war, and powered with big Continental, Caterpillar and International engines of the latest type, these efficient machines deliver cooler, drier air with less fuel consumption than any compressor you have ever owned.

In design they are extremely simple and accessible. In operation they develop full efficiency at 20% to 30% slower piston speed than others, eliminating all usual vibration and increasing the life of both engine and compressor. Giant, air-animated valves, "ultra-lapped" to perfect seating closure, insure free flow and positive delivery of all the air and make frequent valve grinding or replacement a thing of the past.

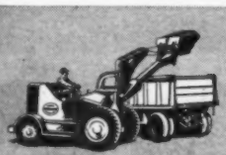
"AIR PLUS" Compressors are sold and ably serviced in 120 cities. Sizes 60 to 500 ft. Ask your Jaeger distributor or write us for Catalog JC-5.

THE JAEGER MACHINE COMPANY, Columbus 16, Ohio

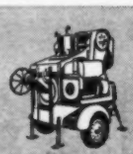
REGIONAL OFFICES: 8 E. 48th St. NEW YORK 17, N. Y. · 226 N. LaSalle St. CHICAGO 1, ILL. · 235-38 Martin Bldg. BIRMINGHAM 1, ALA.

You Get MORE FOR YOUR MONEY in a MODERN COMPRESSOR

- **Air-cooled, 2-stage, vertical compressor—built in a balanced "W", full force-feed lubricated — 3 point suspension — interchangeable precision parts.**
- **100% efficient intercooling, automatic drainage.**
- **Massive main frame with recessed fuel tank, 30% to 50% larger air receivers, bigger tool boxes, lifetime clutches, sectional radiators and intercoolers, electric starter, grouped controls, Timken bearing wheels, "Auto-Steer" axle, etc. all standard.**



"FLEET-FOOT" Loaders



"SPEEDLINE" Concrete Mixers

"SURE PRIME" Contractors Pumps

JAEGER *Engineered* **EQUIPMENT**

JAEGER-LAKEWOOD SPREADERS, FINISHERS AND BITUMINOUS PAVERS, FORMS, FORM TAMPERS—"DUAL-MIX" TRUCK MIXERS, AGITATORS—JAEGER HOISTING ENGINES, TOWERS

these war-born

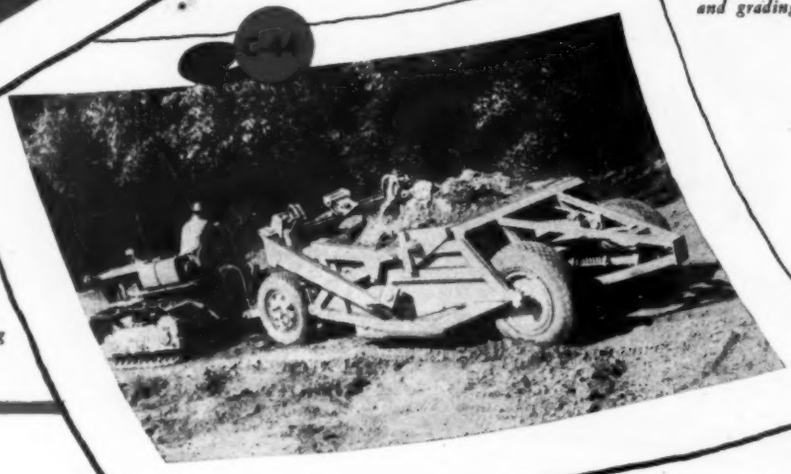
...do scores of peacetime jobs

. . . for counties and states

These little 2 and 4-yard outfits are just what you need for ditching and shoulder work . . . for widening and maintaining roads and driveways . . . for repairing small slides and washouts . . . and for countless other jobs, such as filling in around culverts, bridge abutments, etc.

. . . for small contractors

Good news indeed for thousands of small contractors who have been looking for a low cost, easily transported rig that will enlarge their job opportunities and profit range on all kinds of light excavation, levelling, stripping and grading work.



. . . for farmers

On farms and large estates these thrifty little outfits will pay for themselves in a hurry —building roads and soil-saving dams, filling in feed lots, digging stock ponds and irrigating ditches, levelling off uneven ground, etc.

low in cost, with either

BRIEF SPECIFICATIONS

	Model C-22	Model C-24	Model C-42	Model C-44
Capacity	1¾—2 Yds.	1¾—2 Yds.	4—5 Yds.	4—5 Yds.
Tractor Type	Rubber-Tired Tilting Bowl Front Dump	Crawler Tilting Bowl Front Dump	Rubber-Tired Positive Forced Ejection	Crawler Positive Forced Ejection
Length	13'	16'4"	12' 9½"	17'
Width	71"	71"	92¾"	92¾"
Weight	2550 lbs.	2800 lbs.	6200 lbs.	6500 lbs.

ESTIMATED YARDAGE TABLE

● Here's a reasonable estimate of the number of yards moved per hour by LaPlant-Choate C-22 and C-42 scrapers behind high speed rubber-tired tractors of 22-28 DHP and 40-50 DHP respectively. Yardage is based on self-loading in good scraper material, with properly maintained haul roads.

Model	LENGTH OF HAUL IN FEET								Load, Turn and Dump Time	Pay Yards Per Trip
	200'	300'	400'	500'	600'	800'	1000'	2000'		
C-22	38	32	29	26	24	22	21	17	1.5 Min.	1.75
C-42	69	59	55	52	50	46	44	32	1.75 Min.	3.75

Watch for More Great News!

● This is only one of a series of important announcements designed to bring you pertinent facts about LaPlant-Choate's great new earthmoving line—including many new and outstanding developments in cable and hydraulic operated scrapers, hydraulic dozers, cable and hydraulic power control units—*plus* a new "surprise" in high speed, big capacity earthmoving rigs. So before you start lining up new equipment for tomorrow's jobs, be sure to see the new LPC's—created by LaPlant-Choate's extensive war-time experience and "seasoned" by over a third of a century of engineering and manufacturing "know-how."

We'll be seeing you at the AED Convention, Chicago, Jan. 27-30.

LaPLANT

Engineered

"baby" scrapers

faster... cheaper... better!

... for big contractors

Even large contractors will find it profitable to employ several of these little "commandos" for handling ditching and finishing jobs — and for getting in and around dozens of spots where the use of bigger outfits is often impracticable.

... for general utility

Besides saving time and money on hundreds of light earthmoving jobs around parks, golf courses, cemeteries and industrial properties, these little machines can also be used effectively for removing snow, leaves, etc.

... for railroads

Small ... sturdy ... maneuverable, these "baby" LaPlant-Choate scrapers provide an economical answer to the problems of cleaning ditches along right-of-way, bank sloping, repairing roadway breaks, distributing ballast — and a "101" other utility jobs.

simple to operate... readily adaptable for use crawler-type or high speed rubber tired tractors

Now, for the first time, you can get these amazingly efficient 2 and 4-yard scrapers, fitted for use with either crawler or high speed rubber tired tractors—*at a price within the most modest budget.* Developed especially for the U. S. Airborne Engineers, and used by the hundreds on military projects all over the world, these "baby" LaPlant-Choate scrapers are now ready to help you speed work and reduce costs on a wide variety of peace-time jobs.

Whether you select the inexpensive *2-yard* design with gravity dump, or the larger *4-yard* model with positive forced ejection and controlled spreading, remember both are easily adapted for use with tracks or rubber. Both are equipped with LPC's *improved* single unit hydraulic system for faster, more dependable operation. Both are skilfully engineered to move earth at the *lowest possible cost per yard* within their respective job ranges. So for better results and bigger profits *tomorrow*, get complete facts *today* on these two great new LPC "Carrimors". Just address: LaPlant-Choate Manufacturing Co., Inc., Cedar Rapids, Iowa; San Leandro, Calif.

CHOATE

Earthmoving

owest possible cost per yard

Now-kill weeds!

easily . . . completely . . . chemically

2-4 DOW WEED KILLER

Check Your Weed Problem

- ✓ **Barnyard, fence rows, ditch-banks**
- ✓ **Highways, railroads, utility lines**
- ✓ **Parks and playgrounds**
- ✓ **Fields, orchards, cut-over land**
- ✓ **Irrigation, drainage ditches, canals**
- ✓ **Estates, lawns, golf courses**
- ✓ **Airports, landing strips**
- ✓ **Pasture and ranch land**
- ✓ **Cemeteries**
- ✓ **Vacant lots, roadsides**

See your dealer or write direct

AGRICULTURAL CHEMICAL DIVISION

THE DOW CHEMICAL COMPANY • MIDLAND, MICHIGAN

New York • Boston • Philadelphia • Washington • Cleveland • Detroit • Chicago
St. Louis • Houston • San Francisco • Los Angeles • Seattle

Kill weeds the modern chemical way you have been reading about! Spray 2-4 Dow Weed Killer —to kill weeds easily, completely! 2-4 Dow Weed Killer is more efficient, easier to handle. It kills deep roots—does not sterilize soil or harm grass when used as directed. It's economical. Powder: 4 ounces up to 50-pound drums. Liquid: ½ pint up to 50 gallons.

This is the first of a series of weed killers produced by Dow. Selective weed killers for other specific purposes will soon be available. Keep in touch with Dow and you'll kill more weeds!

DOW

CHEMICALS INDISPENSABLE TO INDUSTRY AND AGRICULTURE

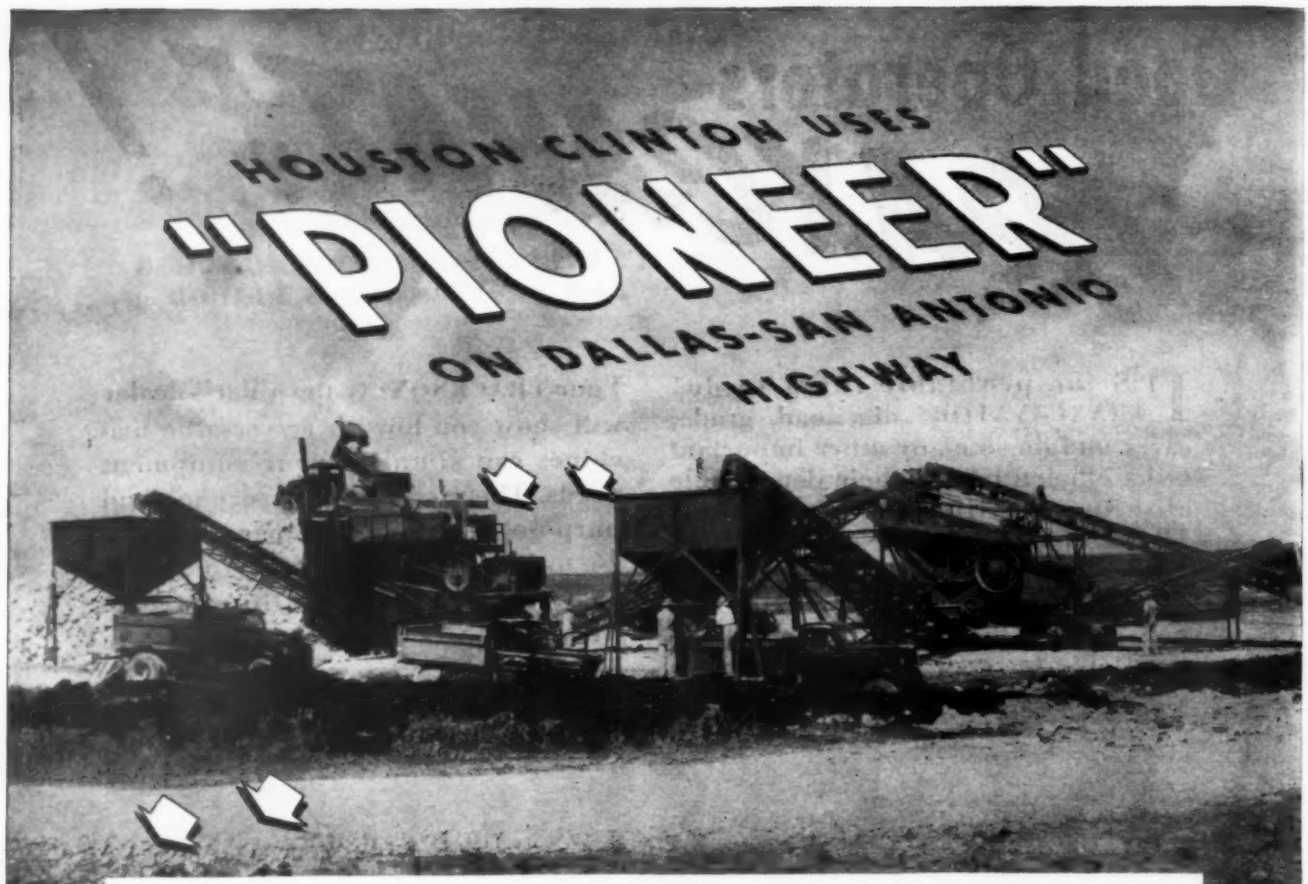
Good Operators TRAXCAVATE!

IT'S THE MODERN MATERIAL-HANDLING AND EARTH-MOVING METHOD

IT'S the profitable thing to do! TRAXCAVATORS dig, load, grade, carry and do so many other important tasks efficiently that their dependable all-around utility seems limitless. TRAXCAVATORS do more work on more jobs . . . are virtually one-machine gangs at most every earth-moving and material-handling task . . . can keep profitably busy all year 'round.

Your TRACKSON-"Caterpillar" dealer will show you how these versatile machines can simplify your equipment needs. There's a size for every job and purpose, with bucket capacities from ½ to 2½ yards. See him today, or write for informative literature to TRACKSON COMPANY, Dept. RS-246, Milwaukee 1, Wisconsin.

1
2
3
4
1 MISSISSIPPI—Loading gravel from pit with TRAXCAVATOR
2 INDIANA — Stripping overburden from gravel pit
3 ILLINOIS — TRAXCAVATOR taking up concrete pavement
4 KANSAS — Loading lime shale to repair damaged roads



● In his first venture as a supplier of aggregate for highway contractors, Houston Clinton of Texas selected Pioneer equipment for the job. This job, which was an important highway project in Hill County, Texas—a connecting link in the Dallas-San Antonio highway—called for 60,000 yards of limestone crushed to 2½ inch for the base course.

To produce this aggregate a Pioneer 24 x 36 primary crusher with a 42-V reduction was used. Averaging between sixteen and seventeen hundred yards per 10-hour day. The operation consisted of crushing soft, white limestone rock which had seams in it, and some dirt had to be removed to meet Federal specifications as to plasticity and binder content. By having a small vibrator screen immediately under the traveling grizzly feeder on the primary unit, this dirt was removed successfully even though the material was wet.

The job was finished on schedule and the plant was shipped to Coleman County, Texas, and set up for another job of a similar type. Because both Pioneer units are mounted on pneumatic tires, making them highly portable, they were moved with a 2½-ton truck, eliminating high freight rates and holding moving costs to a minimum. An economical and profitable job, reports Houston Clinton—proving once again that you get extra margins of performance with Pioneer equipment.

ENGINEERS AND MANUFACTURERS

Pioneer
ENGINEERING WORKS

for QUARRY MINES GRAVEL

Yes Sir! "More features than a cactus has needles", well describes the many advantages of the Huber Rollers. Your nearest Huber Dealer will gladly furnish you with information about these features.

THE HUBER MFG. COMPANY • MARION, OHIO, U. S. A.

HUBER ROLLERS

3 WHEEL and TANDEM • *all sizes* • GAS or DIESEL

PULVERIZING CLAY

LICKING ONE OF THE TOUGHEST HIGHWAY AND AIRFIELD CONSTRUCTION PROBLEMS

SEAMAN MIXER reducing heavy, colloidal clay containing considerable moisture. By drying through aeration, to proper moisture content, the SEAMAN makes excellent pulverization possible.

CLAY

PULVERIZING CLAY. AT THIS STAGE ABOUT 40% PULVERIZING HAS BEEN EFFECTED.

MIXING CLAY AND AGGREGATE FOR NATURAL SOIL STABILIZATION BY CORRECT PROPORTIONING OF BINDER AND LOAD-BEARING SOILS.

TYPIFYING FINISHED CLAY PULVERIZATION OBTAINED WITH THE SEAMAN MIXER.

WIDELY USED AS A BINDER-SOIL IS EXCELLENT MATERIAL

BUT.. to be efficient as a binding agent and to avoid expansion and contraction of lumps — with injury to a mix, — clay must be thoroughly pulverized. Frequently 25% to 50% of the high colloidal clay binders — often brought to a job after a long haul,— is wasted because specified pulverization cannot be obtained. The SEAMAN MIXER, however, even in the case of heavy clays, efficiently and thoroughly effects pulverization,— at drastic reductions in machine time and labor. And with the SEAMAN,— the lighter, more friable clay can readily be pulverized and mixed with other materials at the same time,— two functions in one,— with a far greater daily net output of finished, in-place mix, well-leveled and ready for compaction.

C-116

"SOIL STABILIZATION METHODS" — A most informative book compiled by SEAMAN ENGINEERS. Write for Bulletin RS-24.

PIONEERED BY SEAMAN

SEAMAN MOTORS

MILWAUKEE 3, WISCONSIN

ON LONG & SHORTER HAULS

One of a fleet of TERRA-COBRAS operating on a Trans-Pacific air base on the West Coast

Wooldridge Terra-Cobra self-propelled earthmovers consistently maintain speed up to 21 m.p.h. fully loaded. Positive two-wheel steering control eliminates the necessity of slowing down for rough travel, sharp turns, passing on narrow strips, or spreading on soft fills. Faster round trips from cut to the fill result in greater total yardages at a higher profit and lower yardage cost. *Investigate fully, today.* Write for complete Bulletin TA-425.

WOOLDRIDGE
EARTHMOVING EQUIPMENT
Includes

SCRAPERS
Tractor-drawn for handling heaping yardages from 6 to 28 cu. yards.

★ **POWER CONTROL UNITS**
Single and multiple drum with universal or roller fairleads.

★ **BULLDOZERS**
Tough and rugged design for standard makes of tractors.

★ **TRAILBUILDERS**
Adjustable angle-blades for standard tractor mounting.

★ **RIPPERS**
Available in light, medium and heavy duty models with two sizes to each model.

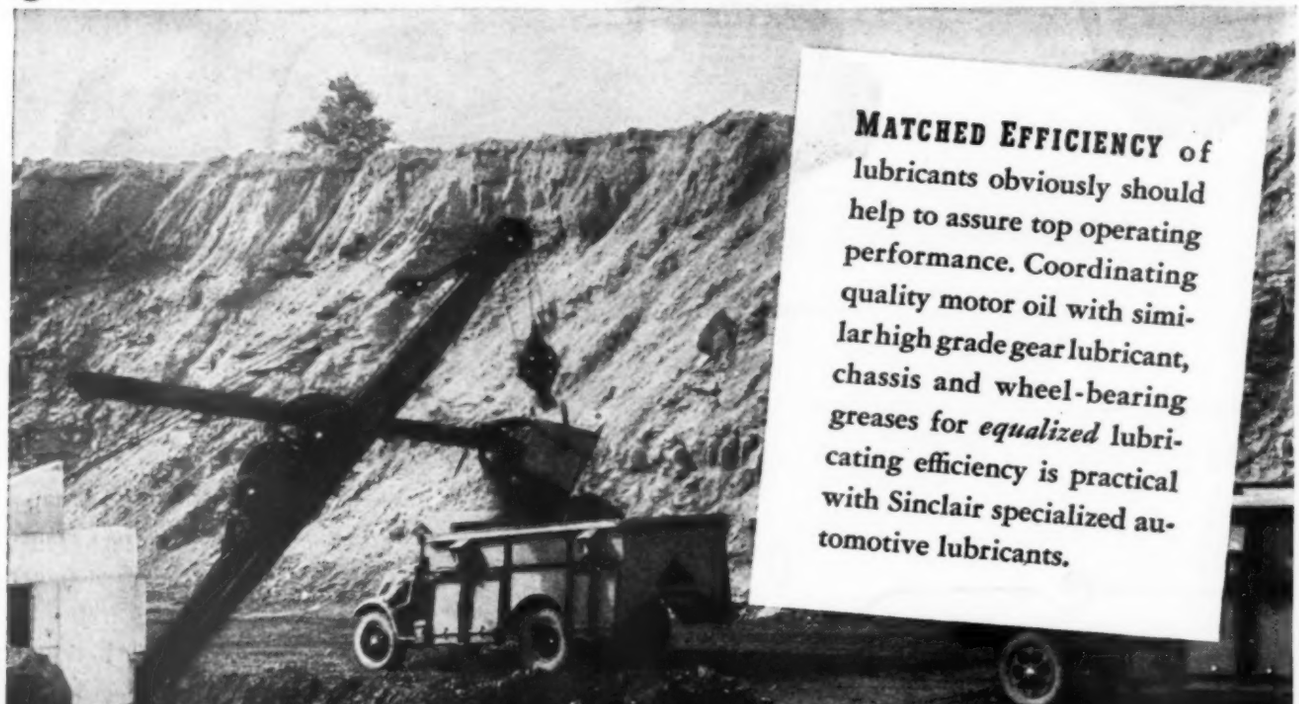
DISTRIBUTOR SALES & SERVICE FACILITIES IN ALL PRINCIPAL AREAS & FOREIGN TERRITORIES

WOOLDRIDGE
MANUFACTURING COMPANY
SUNNYVALE · CALIFORNIA · U. S. A.

TERRA COBRA
Hi-Speed Self-Propelled EARTHMOVERS

SINCLAIR MATCHED LUBRICANTS

for Top Operating Efficiency



MATCHED EFFICIENCY of lubricants obviously should help to assure top operating performance. Coordinating quality motor oil with similar high grade gear lubricant, chassis and wheel-bearing greases for *equalized* lubricating efficiency is practical with Sinclair specialized automotive lubricants.

SINCLAIR OPALINE* MOTOR OIL offers positive engine lubrication, free acting rings, resistance to carbon deposit and crankcase accumulations, avoidance of bearing corrosion . . . OPALINE GEAR LUBRICANT provides extreme pressure lubricating protection to prevent galling and scuffing, resists oxidation under operating temperatures, and is free flowing under Winter conditions . . . OPALINE CHASSIS LUBRICANT has "staying" properties and built-in extreme pressure characteristics . . . and for wheel bearings SINCOLUBE is designed to meet service temperature and pressure requirements, also keep an adequate lubricating film on balls and rollers, with freedom from leakage to brake linings and hubs.

• • •

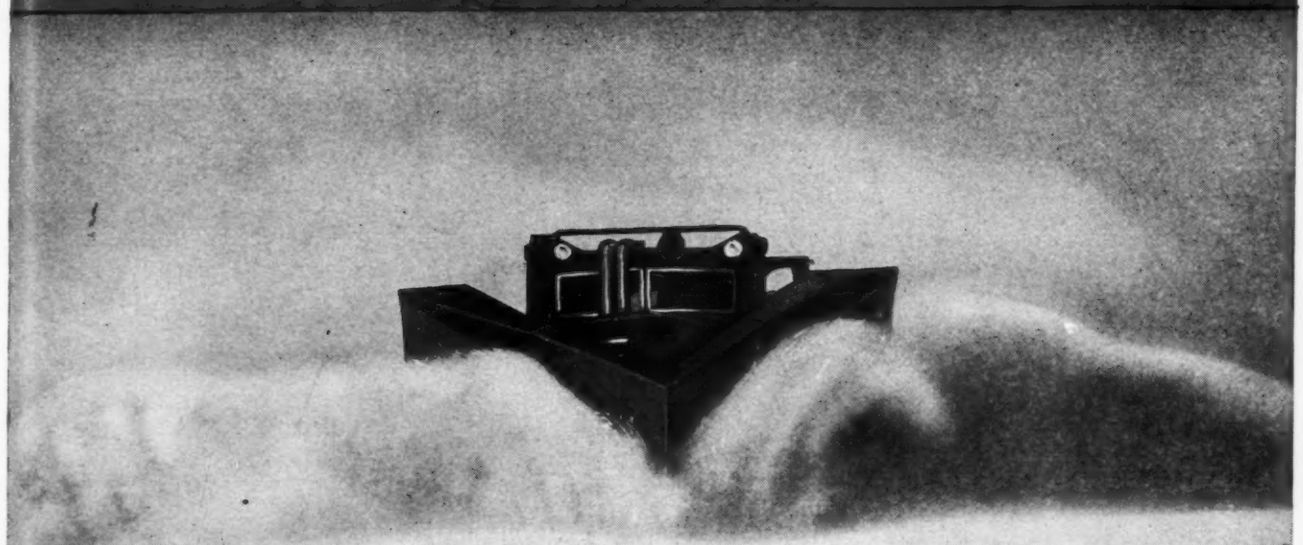
Try these matched lubricants for top operating efficiency and economy.

*Reg. U. S. Pat. Off.

SINCLAIR LUBRICANTS-FUELS

FOR FULL INFORMATION OR LUBRICATION COUNSEL WRITE SINCLAIR REFINING COMPANY, 630 FIFTH AVENUE, NEW YORK 20, N. Y.

THROWS SNOW *Farther*
because it Clears Faster!

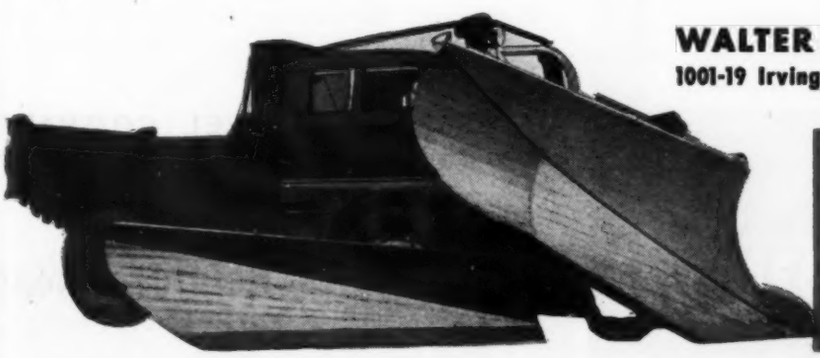


WALTER SNOW FIGHTERS
Clear a 28 ft. Lane at 20-30 m.p.h.

● You clear more miles per hour with Walter Snow Fighters because they remove a greater volume of snow on each run. Having the power and traction to maintain speeds of 20 to 30 m.p.h., Walter Snow Fighters throw snow far off the road. Less snow remains to be re-handled on subsequent runs. Widening out is easier and faster. Danger of frozen ruts and ice is diminished. In fact, a two-lane road can be cleared in ONE round trip with the 250 h.p. Walter Snow Fighter.

Only Walter Snow Fighters provide this high-speed performance because they have the exclusive Walter Four-Point Positive Drive, which proportions the power to the FOUR driving wheels according to their traction at any instant. This eliminates wheel spinning and prevents skidding, stalling and side slipping. It enables drivers to hold a straighter course at high speeds and in deep snows.

Write today for a complete description of the many features that make Walter Snow Fighters the most effective weapon against snow-clogged highways.



WALTER MOTOR TRUCK COMPANY
1001-19 Irving Avenue, Ridgewood 27, Queens, L. I., N. Y.

WALTER
SNOW FIGHTERS

SUPER ROADS NEED SUPER STRENGTH

Many sections of the famous Pennsylvania Turnpike have demonstrated, through five years of gruelling service, the protective advantages of *Pittsburgh* Welded Wire Reinforcement.

Pittsburgh Reinforcement *Gives it!*

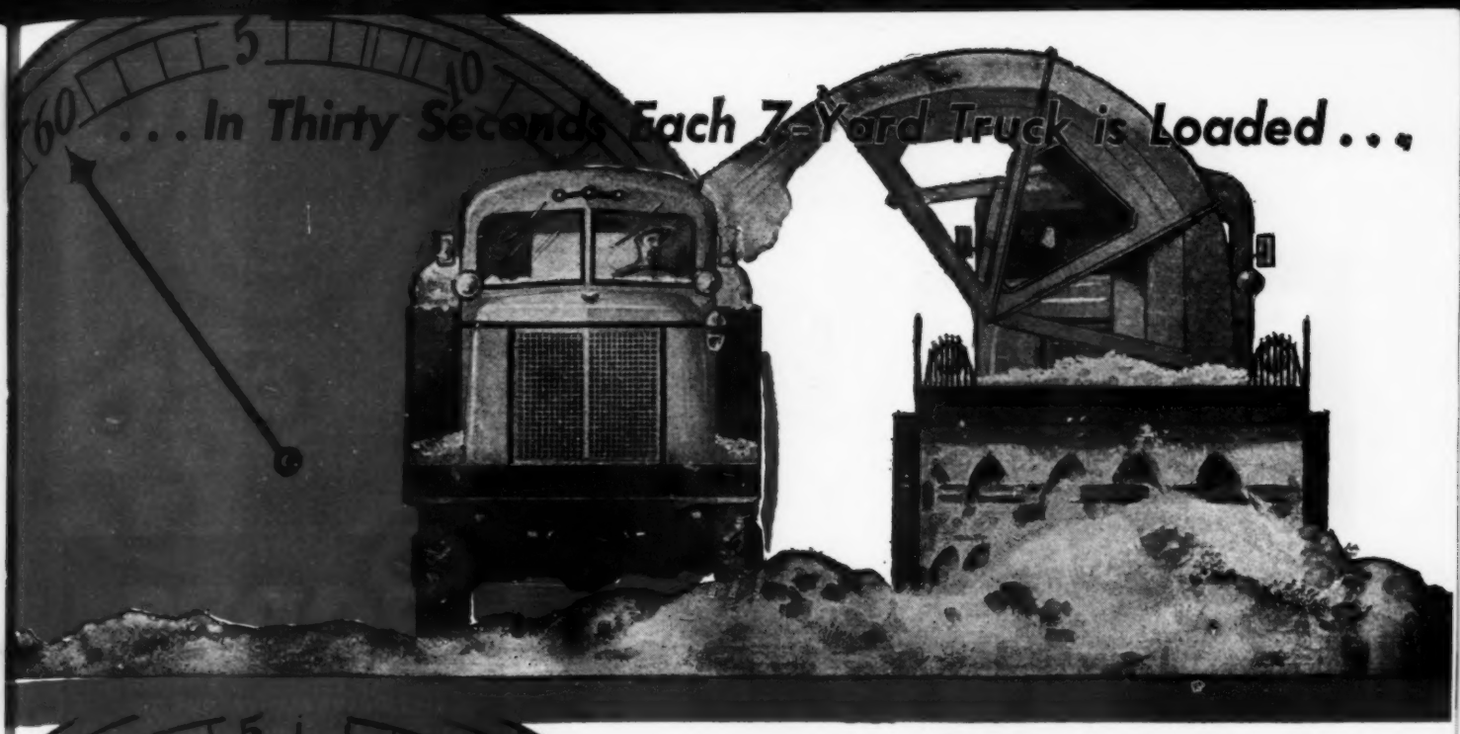
Highways of tomorrow . . . super roads for super loads . . . will need the super strength which *Pittsburgh* Welded Wire Reinforcement imparts to concrete.

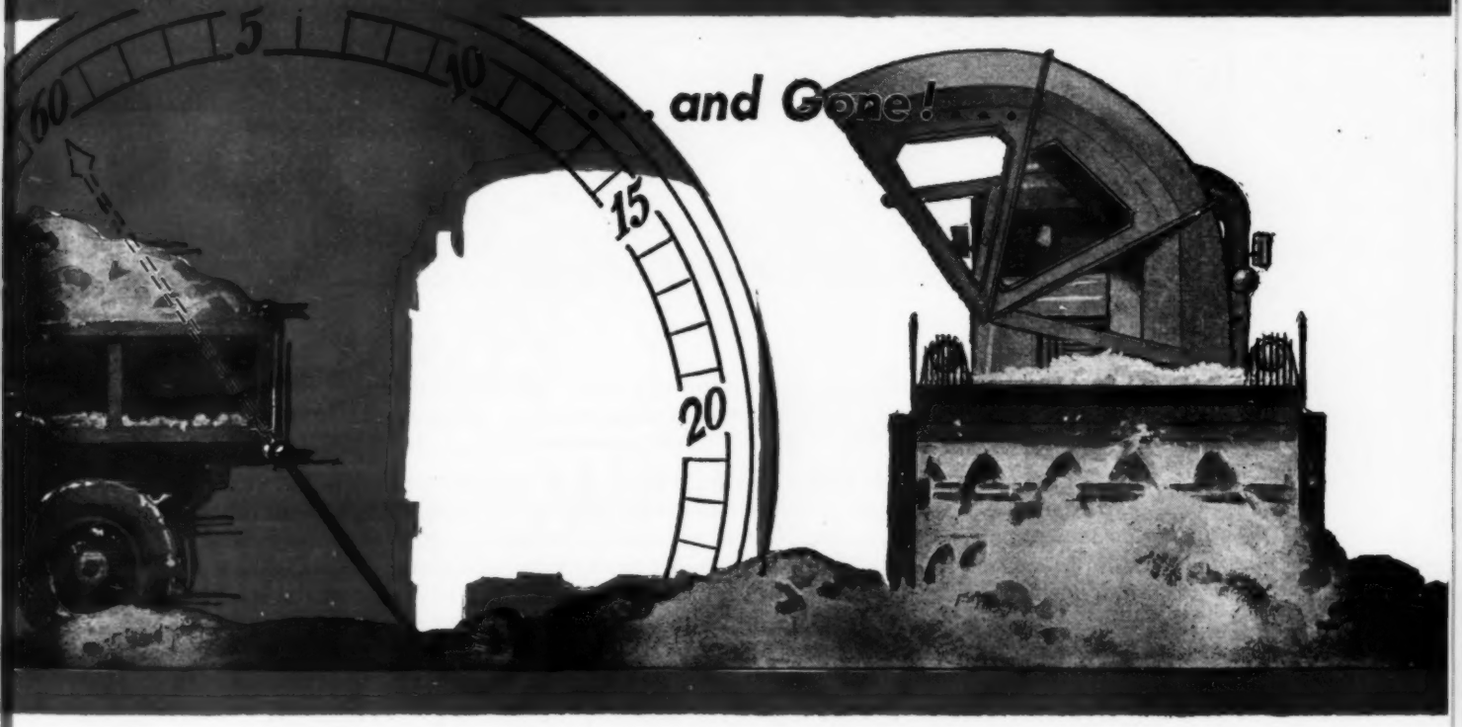
By literally "binding" concrete into integrated slabs of far greater strength, *Pittsburgh* Reinforcement minimizes the effects of destructive forces, be they from weather or from traffic. It prevents the spread of incipient cracks induced by moisture and freezing and compensates for the stresses caused by differences in expansion between surface and subgrade. Likewise it provides greater resistance to traffic loads, thus reducing maintenance and preserving the monolithic beauty of the highway.

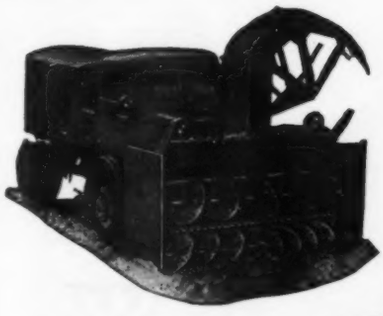
Proved in the roads of yesterday and today, *Pittsburgh* Reinforcement is destined to help make the highways of tomorrow really "super." Write about it.

PITTSBURGH STEEL COMPANY
1661 Grant Building . . . Pittsburgh 30, Pa.

Pittsburgh **Welded Wire Reinforcement**







RAPID clearance of traffic lanes so that business can return to normal is the most important aspect of snow clearance. Speed is achieved by mechanical efficiency. The Sicard SNOW BLOWER loads a 7-yard truck in thirty seconds . . . 120 trucks in an hour. Clears seven times as much as when ordinary methods are used. A Sicard SNOW BLOWER can save its cost and more in a single season. Let us demonstrate.

SICARD

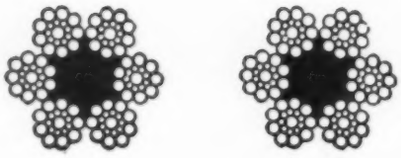
SNOW BLOWERS

Address Inquiries to
SICARD INDUSTRIES INC. • 74 Peru Street • PLATTSBURG, N. Y.

RUBIES

Two rubies, one real, the other synthetic, may look alike, yet differ in value.

and



ROPES

Two pieces of wire rope may be of identical construction yet differ in performance.

The purchaser of wire rope isn't buying wire rope, but the service that rope will render on the job. And wire rope performance is dependent not alone on its "construction" but upon the quality of the wire used in its manufacture.

Back of the long service which Wickwire Spencer Wire Rope renders is 125 years of experience. The steel is made in our own open hearth furnaces. This type of refining furnace removes all but absolute minimum quantities of harmful phosphorus and sulphur. It also permits blending of proper proportions of carbon and manganese to produce rope wire that meets exacting specifications. Only the heart of the steel ingot is used for rope wire. This is carefully rolled, drawn and processed to produce wire with the highest possible degree of hardness, strength, toughness and fatigue-resisting properties.

Every wire is drawn until it is accurate within a fraction of a thousandth of an inch . . . an important fact to remember since the performance and durability of wire rope is dependent upon accurate coordination of each component part.

Even though wire rope is tough, it is a delicate mechanism and as such is deserving of care to insure longer service. To help you get such service we have available an 82 page book packed with useful ideas for lengthening rope life. It's yours for the asking. And, if you have any problems regarding wire rope our engineers will be happy to help in their solution.

WICKWIRE SPENCER WIRE ROPE . . . IN ALL CONSTRUCTIONS FOR EVERY NEED

WICKWIRE SPENCER *Steel*

A DIVISION OF THE COLORADO FUEL AND IRON CORPORATION
EXECUTIVE OFFICES—500 FIFTH AVENUE, NEW YORK 18, N. Y.

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and READ the MERITS of....

KEYSTONE SNOW PLOW LIGHTS

A SPECIALLY DESIGNED HEAVY-DUTY LIGHT WHICH WILL GIVE UNINTERRUPTED SERVICE UNDER DIFFICULT OPERATING CONDITIONS.

INSTALL KEYSTONE SNOW PLOW LIGHTS NOW AND ENJOY THE SAFETY THAT YOU WILL HAVE WITH THESE FLASHING WARNING SIGNALS.

MADE SPECIALLY FOR HIGHWAY WORK IN BAD WEATHER, THEY ARE MADE TO FIT YOUR NEEDS, WON'T SHAKE APART, WATER CAN'T GET IN AND SHORT THEM OUT. THEY'RE LONG LIVED AND A GOOD INVESTMENT FOR EVERY HIGHWAY DEPARTMENT, LARGE OR SMALL. UNIVERSALLY USED IN SNOW PLOWING.

AUTO GEAR & PARTS COMPANY
HUNTING PARK AVE.
ROOSEVELT BLVD. and 16th ST.
PHILADELPHIA 40, PA.

YOU'LL NEVER SEE A DISTRIBUTOR OPERATE AS EASILY AS A "SPRAY MASTER"

With Vacuum-Flow Full Circulating Spray Bar, the "Spray Master" sprays material at desired Spray Bar Width.

The "Spray Master" will apply Bituminus material to any Road, Street or Highway with the least amount of effort and at less operating cost than any unit of its kind. No matter what width spray bar is desired, up to 24 feet, the "Spray Master" just puts the material down like a carpet. With the Vacuum-Flow Full Circulating Spray Bar the individual nozzles can be turned off giving the desired spray bar width for the job. The operator turns the Single Control Valve to Spray and instantly the most efficient spray job is under way. When the end of the job is reached the operator turns the control valve to Circulate and the spray stops instantly. Circulating by Vacuum eliminates any pressure on the spray bar assuring an instant cut off of the spray. Make your next unit a "Spray Master," the Master of Bituminous material Spraying.

Above—"Spray Master" with Standard 2" tubular spray bar with engine mounted at the Rear.

Below—Front engine "Spray Master" with controls at rear. Choice of Front or Rear Engine can be had.

BLACK TOP ROAD MAINTENANCE EQUIPMENT LB SINCE - 1900

LITTLEFORD

LITTLEFORD BROS., Inc.

454 E. PEARL ST., CINCINNATI 2, OHIO

UNIT 1020

for the TOUGH *jobs*

10 TON CRANE

Consider these exclusive features *not* found in any other comparable crane or shovel:

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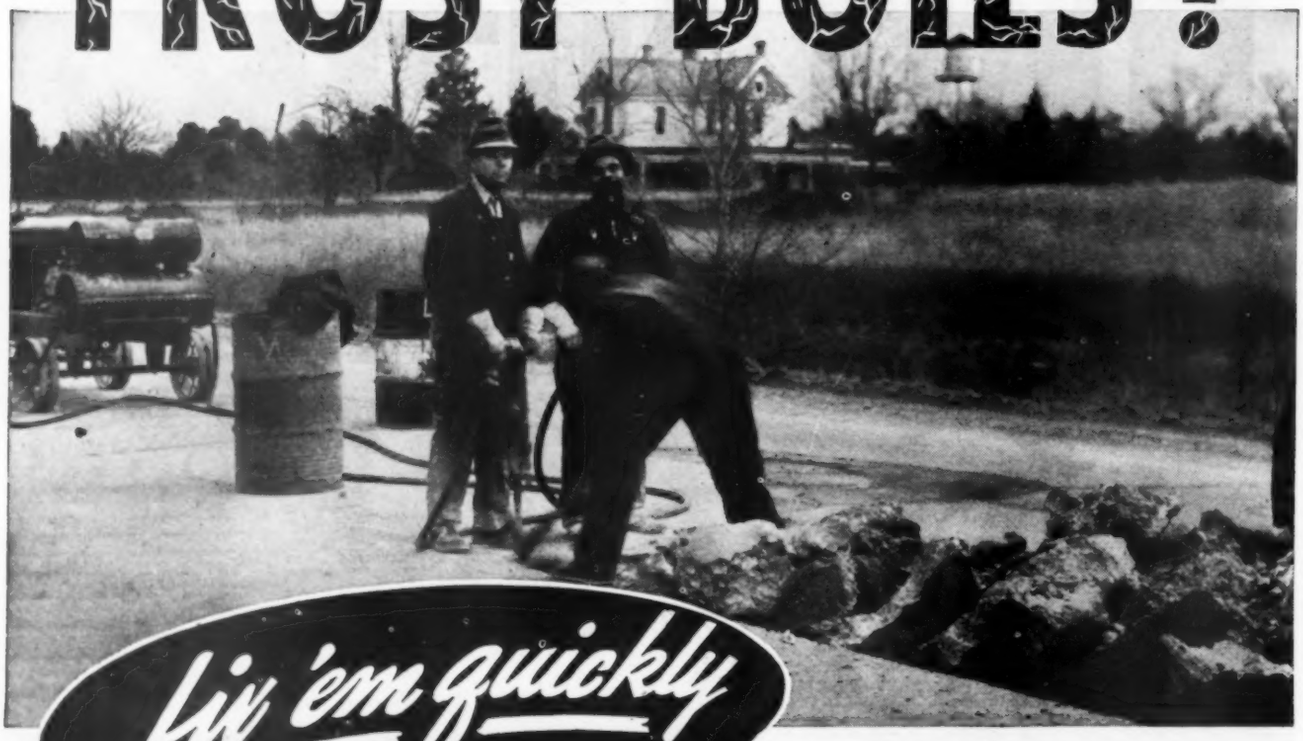

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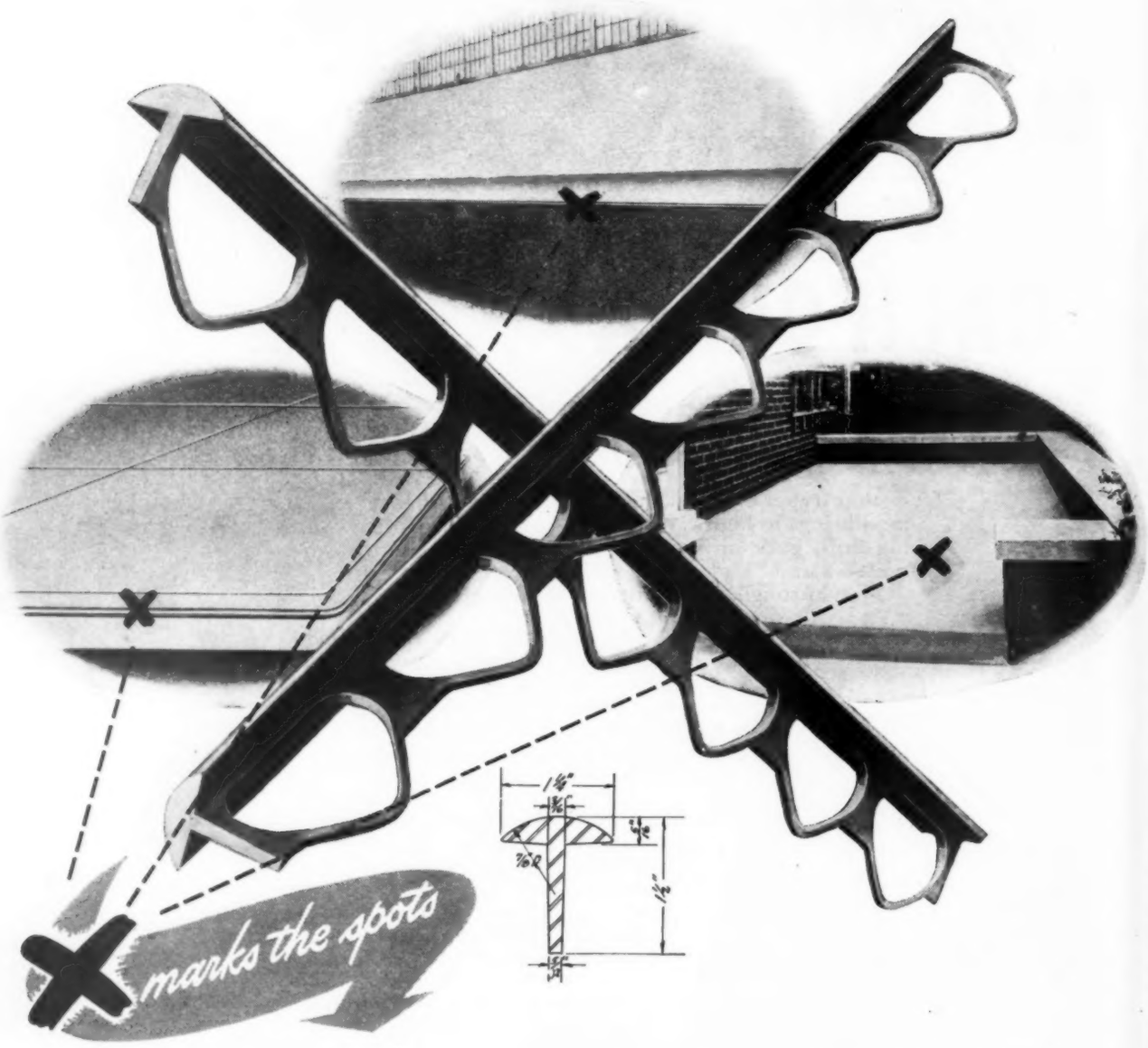

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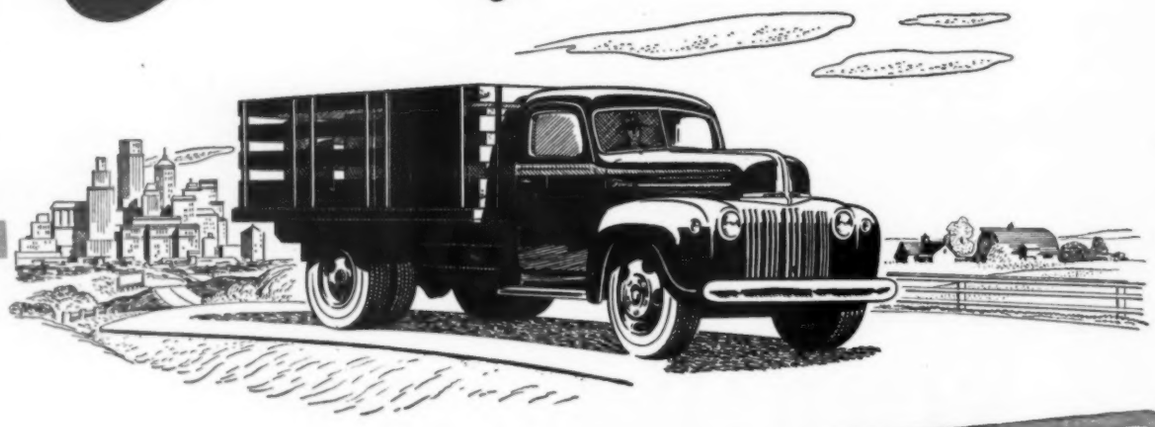

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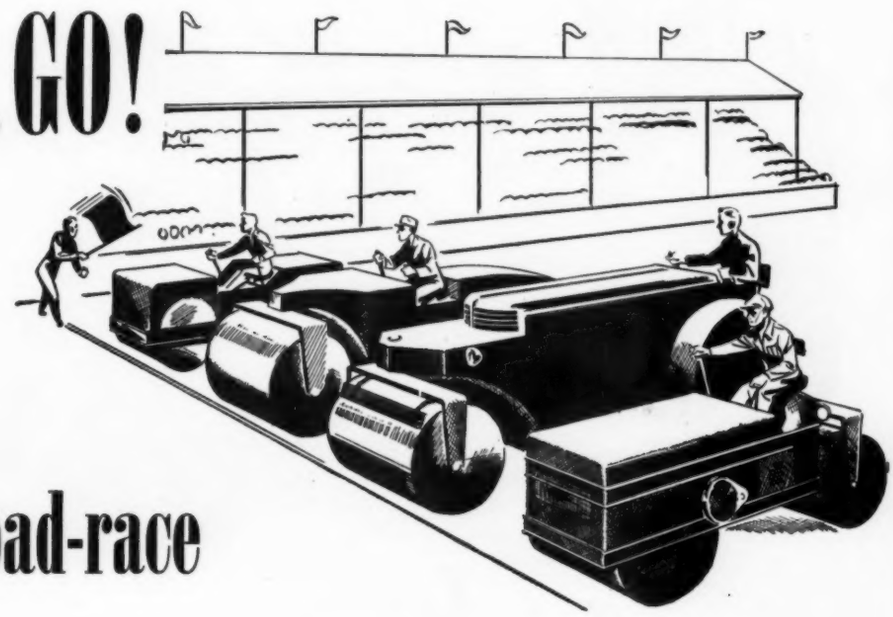

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To make sure of no interruption to your program, do these four things:

1. Lay out your 1946 plans now.

2. Accurately estimate your needs for asphalt.

3. Contract for them now.

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Then keep in touch with the Standard Oil Asphalt Representative in your locality. When you are ready to start work, he can in many ways help you to keep asphalt flowing to the job when and where you want it.

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On every battle front G.I. Joe saw proof of GMC's pulling power. In the South Pacific, in temperatures as high as 130 degrees, GMC "six-by-sixes" hauled huge loads through hub-deep mud and sand. In Europe, GMCs played the leading role on the famous Red Ball Express. In Alaska's ice and snow, Burma's jungles and Italy's mountain trails... wherever heavy loads were pulled through heavy going... GMCs did the job.

G.I. Joe knows about GMC pulling power... and what he can tell you is mightily important to truck buyers. For GMC commercial models, ½ to 20 tons, have engines of the same basic design as their military brothers. They offer the civilian counterpart of the power, performance and stamina demonstrated by nearly 600,000 GMC "Army Workhorses."

The famous "270" engine, power plant of the "Army's Workhorse," also powers GMC models in the 3-ton range. All other GMC gasoline engines are of the same basic, war-proved design.

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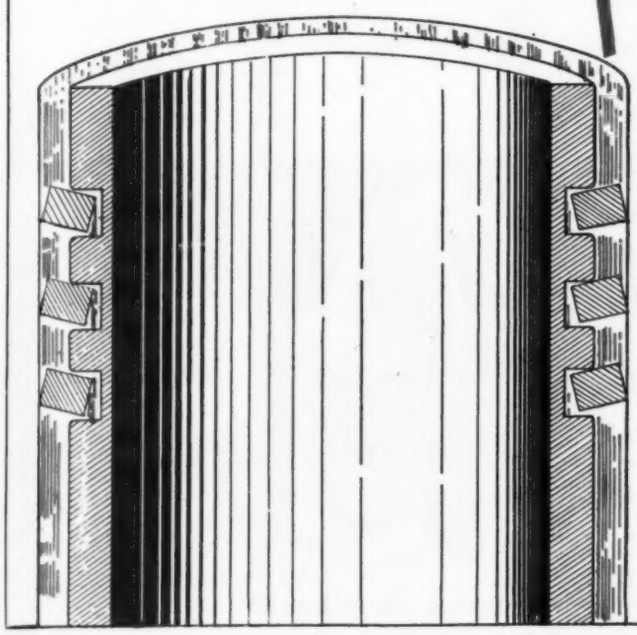
Diesel Engine DANGER points



"ROCKING" PISTON RINGS SCORE LINERS

"Rocking" piston rings, the result of excessive wear in the ring grooves of Diesel engine pistons, are the source of considerable lay-off time and expense to Diesel operators—Wear-enlarged grooves permit rings to rock, and "bite" into cylinder walls. The result is usually a costly overhaul to replace not only pistons, but worn liners as well. It's a danger point in many Diesels—but "rocking" rings and their cause, enlarged ring grooves, can be minimized.

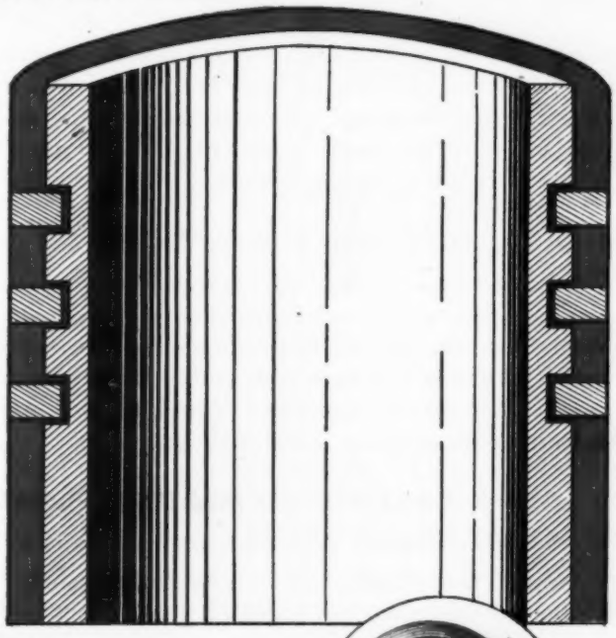
RPM DELO Oil clings to hot engine areas often left exposed to wear by ordinary uncompounded oils.

RING GROOVE WEAR REDUCED BY RPM DELO OIL

In a series of 1000-hour laboratory tests, Standard scientists proved that ring groove wear can be minimized with RPM DELO Diesel Engine Lubricating Oil.

Piston ring groove wear in an engine operated on a top quality straight mineral oil was thirty times that experienced with RPM DELO Oil in an identical test.

RPM DELO Oil reduces wear due to a metal-adhesion additive which makes it cling to and lubricate hot engine areas other oils often leave bare, and to other compounds which eliminate stuck rings and engine deposits, prevent bearing corrosion, stop oil foaming.



To match the fine performance of RPM DELO Oil use these equally efficient companion products from the same famous "RPM" line—

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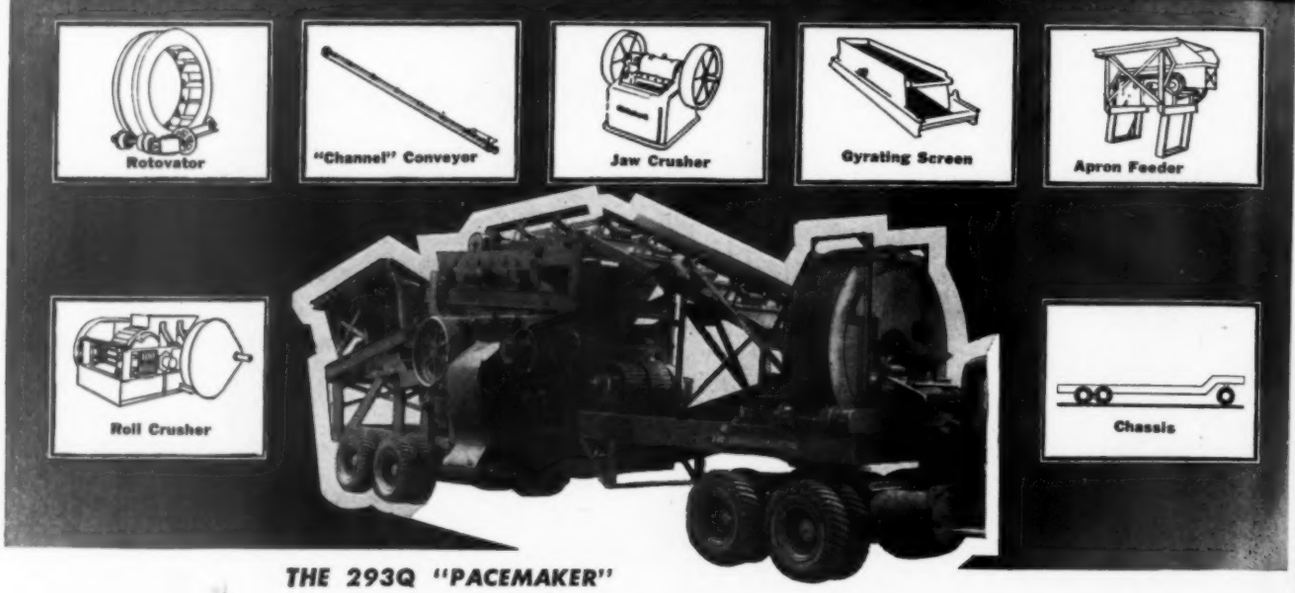


THE 293Q "PACEMAKER"

A Complete Dual Crusher Quarry Plant on Wheels Made From Seven Balanced Universal Basic Units

"Basic Units" are the fundamental parts (jaw and roll crushers, pulverizers, elevators, conveyors, hoppers, bins, feeders, sand drags, sand screens, settling tanks, gyrating screens, etc.) upon which all successful crushing, screening and washing depends. Universal builds over 20 "Basic Units" which offer the following advantages to producers:

1. ADD TO PRESENT EQUIPMENT

Universal "Basic Units" are soundly designed to produce top quantities of specification products, and built of the finest materials to assure long service life. They are made in sizes and types to fit into any existing set-up to increase plant efficiency and output, or to produce a different product.

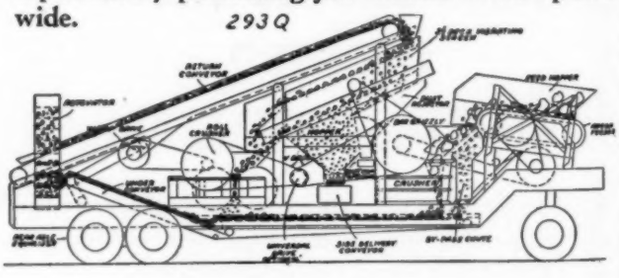
2. GET A TAILORED-TO-MEASURE PLANT AT STANDARD PRICES

By using "Basic Units," practically "off the shelf," Universal engineers can build plants to meet any needs, thus effecting important savings in initial cost.

3. GET A COMPLETE BALANCED UNIVERSAL BUILT AND DESIGNED PLANT

Many standard plants of superior design such as the 293Q "Pacemaker" Portable Quarry Plant, shown above, are made from Universal "Basic Units." The "Pacemaker" features Universal's exclusive Two-In-One Rolls which handle two sizes of material at one time, thus producing large capacities by permitting jaw crusher to be opened wide.

293Q



Investigate the many advantages of Universal "Basic Units" and complete plants to assure yourself of larger profits from the coming construction activity. Send for Bulletin today!

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UNIVERSAL
ROCK AND GRAVEL CRUSHING AND SCREENING PLANTS
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A single-cylinder, twin-arm hoist for 1½ to 2½ ton trucks.

A twin-cylinder, twin-arm hoist for 8 to 20 ton trucks.

A twin telescopic hoist for rock and ore bodies.

BH-117

Heil Bodies and Hoists are built to lick the Tough Jobs

The ability of Heil Bodies and Hoists to give you extra years of profitable service has been proved wherever tough working conditions test soundness of design and quality of materials.

Heil units are built to take the punishment of the tough jobs . . . to give you quick, clean dumping under all operating conditions . . . extra speed that enables you to haul more loads per day . . . and more profit on every load you haul.

Compare such features as the heavy-duty sub-frame . . . reinforced body floor . . . simple arm construction . . . precision-machined pump . . . etc. — and you see why Heil quality construction assures you of dependable, profitable service with a minimum of "time out" for service and repair.

For complete details, see your Heil distributor.

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STRIPPING IN A "STREAM"

—but these tires keep loads moving!

HERE'S where work-tires take a daily bath and beating — and come back for more.

On the Wade and Richey Company's coal-stripping job in Alabama, seven trucks like the one above — all equipped with Goodyear Hard Rock Lug tires — haul away the coal. But a perverse creek nearby puts much of the area under several feet of water. So loads must be pulled through sticky mud and slime — often over submerged and murderous rocks, shale, sharp stones.

Yet these Goodyears — all veterans of many months of rough and rugged service at various ore and quarry operations before their transfer here — are delivering top-notch performance on this tire-killing job because they're built tough for tough going, have the stamina to take long punishment.

The other Goodyear off-the-road tires, too, are job-proved, high-hour performers — the great Sure-Grip with *open center* tread for drive wheels where traction counts most, and the time-proved All-Weather Earth Mover for drawn vehicles where easy rolling is a must.

And because these tough work tires consistently deliver lower costs-per-ton-mile, more and more contractors now buy Goodyears for their units. Chances are you will, too, once you get the story from men now using them.

Sure-Grip, All-Weather—T.M.'s The Goodyear T. & R. Co.

GOODYEAR

MORE TONS ARE HAULED ON GOODYEAR TRUCK TIRES THAN ON ANY OTHER KIND

ROADS AND STREETS

FEBRUARY, 1946 • VOL. 89 • No. 2

Stabilization Pointers

from our Michigan experience

Necessity of continuous control and value of plant mixing of stockpiled aggregates stressed in this article, given as a paper at the recent ARBA convention. Avoidance of high-capillary subbases, and of placement in rainy season, among rules for successful construction

By Charles M. Ziegler
Highway Commissioner of Michigan, Lansing

MICHIGAN'S very satisfactory experience with the stabilized road has caused considerable interest in this type of highway in other states. It must be realized this type of road has a definite place in the highway program. It is not for heavy industrial traffic, but it can be used as a low-cost base for a bituminous surface on medium-traffic roads.

Stabilization can be considered as a combination of binder soil and aggregate preferably obtained at or near the site of stabilization, manipulated and treated with or without chemical admixtures, and compacted so that it will remain in its compacted state without detrimental change in shape or volume under the action of traffic and the exposure to weather.

A well-stabilized road surface is one that will be relatively dustless in dry weather and not slippery in wet weather. The stability is derived from the interlocking action of the granular components during periods of continued wet weather and the cohesion of the binder soil and moisture films during dry weather.

★ Stockpiling enables plant mixing to proceed faster than production rate of typical crushing plant

★ Michigan requires all stabilization materials to be stockpiled to insure uniformity of gradation

Better Secondaries Relieve Arterials

The stabilized gravel road fills a definite need in our state's highway system. Well maintained smooth and dustless surfaces on our secondary roads tend to reduce traffic density on our main arterial highways during peak traffic periods. Motorists are willing to use the secondary trunkline system if their convenience, safety, and pleasure are not threatened by rough, dusty surfaces.

The stabilized road is relatively low in cost due primarily to the use of local materials. However, well controlled stabilization also saves the road surface, saves costly patching, delays resurfacing and greatly reduces the cost of blading by lengthening the interval between the periods when this operation is necessary or desirable. Furthermore, the stabilized road fits in very well with "stage" construction thereby saving the original investment when bituminous surfaces are applied.

Michigan's experience with road stabilization dates back 20 years; in fact, back to a time when it was first noted that certain gravel deposits made excellent roads while others ravelled and proved costly to maintain. An analysis of the good roads indicated the mechanical gradation and cohesion of the material that made up the road surfaces were uniform. That is, they had a uniform grading and contained sufficient binder material to form a densely graded, stable mat.

Following this discovery, an attempt was made to provide, on those sections of road that were not standing up under traffic, the necessary materials for a well-stabilized mix. In some cases it was necessary to add sand or gravel, and in others, binder material.

Early Need for Control

During the first few years of stabilization the material that was deficient was applied to the road and blade-mixed in place. By this method some very excellent results were obtained. However, after a few trials of this procedure it was noted that the results were not uniform. True, in some cases, the results were very satisfactory but in others there were sections where too much binder caused them to be slippery when wet, while on other sections of the same job, insufficient binder caused the surface to ravel and become dusty.

Again an analysis of the material showed a wide variation in the gradation of the mix indicating lack of accurate control either in the application of the material, or in the mixing, or both. The idea was then advanced that *to have uniformly well-stabilized roads it is absolutely necessary to have an accurate control of all operations.* To provide this control the production of stabilized gravel by plant-mix was introduced.

The economy of production of stabilized material by the plant-mix method is aided greatly by knowledge of material location, the characteristics of these materials and by a predetermined design of mix made to fit the materials available.

As an aid in the designing of a mix before bids are taken, the Soil Engineers have, on the basis of the soil type classification, located and made a material inventory of adequate sources of binder soil and aggregates in all the counties where the soil classification indicates that materials may be suitable for stabilization. The material inventory for road gravel and binder soils has been a considerable aid in handling a large stabilized aggregate program from the standpoint of testing.

These various material locations have been assigned pit numbers provided actual material has been used or test data is available on the soil properties. All material locations have been described to the nearest quarter section. The pit numbers and test results have been tabulated under counties and cross indexed with one or more names which may have been used locally to designate the deposit. This information has been tabulated in book form and has been made available to all contractors bidding in Michigan. Adequate information on material sources tends to lower contract prices for stabilization since contractors not familiar with certain areas can select the source of materials without costly exploratory investigation.

Adequate information on certain locations and characteristics of the materials used in the stabilized mix tends to lower the cost and definitely increases production.

The binder soil should consist primarily of fine soil particles which contain less than 5% of organic matter and no stones larger than permitted in the stabilized mixture. If a clay shredder or disintegrator is used, the presence of stones may be disregarded as they will be crushed to size or ejected. The binding properties of the soil should be such that it produces the required physical characteristics in the finished mixture.

All binder soils should be approved before starting the production of aggregate, as many cases are found where the grading of the aggregate must be altered to allow for use of available binder soils.

Two types of chemicals are used as binder conditioners for stabilized aggregates. One group, such as calcium chloride, depends upon deliquescent and hydroscopic properties; the other group, such as sodium chloride, upon their cementing properties. Both types should be in solution to secure the maximum benefit of their useful properties during the compaction of the stabilized materials. Calcium chloride and sodium chloride are the two principle types of admixtures, although natural salt well brine and brine residue have been used in areas close to the source of supply.

★ Mechanical spreaders highly satisfactory for placing materials

Organic Matter and High P.I. Clays Detrimental

The grading analysis and plasticity tests are usually required for the design of stabilized mixtures. If the aggregate and the binder soil have been taken from soil types correlated with physical soil tests, the essential control can be reduced to grading tests. The production of uniform coarse aggregate and the restriction of soil fines (passing 200-mesh) permits the design of stabilized materials on the basis of grading tests. Very few cases occur in production of coarse aggregate where the material passing a 200-mesh exceeds 5%. The soil fines are mostly silt, since the top soils covering the aggregate deposits are usually removed prior to production. This practice of stripping deposits has been adopted to eliminate organic matter and other objectionable soil fines.

Usually binder soils with plasticity indices (P.I.) greater than 25 are difficult to disintegrate and mix uniformly with the coarse aggregate when their natural moisture is above the plastic limit. High P.I. clays should be avoided when stabilizing during the wet season of the year. If they must be used, they should not be removed from the deposit prior to the period of processing the coarse aggregate, since they are apt to absorb less moisture in the undisturbed state than they will in a stockpile. If the moisture content of the clay deposit in its natural state is above the plastic limit, some benefit may be derived from stockpiling the clay and protecting it from excessive rain or snow so it can air dry prior to its use for stabilization.

The lower P.I. clays usually are apt to be less affected by adverse weather conditions. In general the lowest P.I. binder soils, which can be used properly, will aid in obtaining high production of stabilized materials. Time and effort spent by the engineer or contractor to locate and use low P.I. clays will pay dividends. It often has been more economical to produce the coarse aggregate low in fines and make use of a sandy binder soil rather than produce a sandy aggregate and stabilize with high P.I. binder soils.

★ Mechanical spreader eliminates need for side forms and cuts compaction period

Proper Crown Essential

Usually the crown for stabilized roads is varied from 2½ to 5 in. for a 21-ft. width. The lower limit is recommended for base courses which will receive a bituminous surface shortly after the base has been compacted; the upper limit for wearing courses, or bases which are to be carried over to a future season before the placement of bituminous surfaces. In addition to the plasticity requirement of the stabilized mixtures, it has been necessary to add chemical admixtures to aid in the rapid compaction of the material after placement on the road. Usually 5 to 15 lb. of calcium chloride or 10 to 20 lb. of sodium chloride per ton is added to aid compaction. Dependent upon the climatic conditions, the quantity may be varied by the Engineer.

Water is added to the stabilized mixtures during the mixing operation. These mixes are usually designed slightly above the optimum moisture content to compensate for the loss of moisture by evaporation during the compaction period.

Stockpiling Required

The plants operating in Michigan are either of the continuous or of the batch type. Several types of batch plants are used, but it appears that the continuous type plants generally have been considered to be better for producing stabilized material and to have lower operating costs.

A study of test results indicates that a high degree of uniformity of

grading can be expected when materials are stockpiled prior to the stabilization period. For this reason the Michigan highway department requires that all materials used in stabilization must be stockpiled. The use of stockpiled materials enables the contractors to obtain maximum efficiency from their stabilizing units although causing a rehandling. Under previous specifications, these plants could be limited by the production of the portable gravel plants. The process of stabilizing of aggregates averages 25 tons per hour and in extreme cases as much as 60 tons per hour more than the production of the average portable gravel plant. This increase in efficiency more than compensates for the extra cost of stockpiling materials prior to stabilization.

The average production of stabilizing plants in Michigan during 1939 was about 75 tons per hour computed on the basis of 20-day month and a 10-hour day. The above production rates take into consideration all delays arising from unfavorable weather conditions, plant breakdown and days on which the plant does not normally operate. Cost of stabilizing adds about 35 cents a ton to the normal production cost of gravel. This additional cost, however, is more than offset by reduced maintenance costs and improvement in the quality of surface.

Close Inspection Vital

Experience indicates that satisfactory plant mix stabilization is dependent upon rigid field and laboratory inspection during the production of the materials. The variations in local deposits are difficult to control and it is necessary to have *continuous* inspection to insure satisfactory results.

The Michigan department has developed the following inspection routine to insure quality production of plant mix stabilized materials. Prior to starting the aggregate production the sources of aggregate and binder soils are tested unless they occur in soil types which are known to be satisfactory for stabilization work. The samples are sent to the laboratory by a district soil engineer, or in some cases, by the travelling materials inspector. After the materials have been tested and approved by the laboratory, an inspector is assigned to the project to control the quality of the stabilized mix.

The inspector uses gradation tests to control the production of material. On the basis of these tests extreme variations in grading are corrected by regulating the amount of sand ejected during the crushing and screening of the material, or by regulating the amount of oversized material that is being crushed. Often the remixing of bank-run material will correct variations in grading. Sometimes several faces of the gravel deposit can be worked simultaneously to correct variations in grading. In some cases the produced material may lack a sufficient quantity of material passing the No. 40 sieve and retained on the No. 200. This material must be mechanically added to the binder soil at the stabilizing plant in case a suitable binder soil cannot be found to correct the deficiency at the time the material is stabilized. All the coarse aggregate must be produced and stockpiled in layers, prior to stabilization. This procedure reduces to a minimum any minor variations occurring in grading during the production of the coarse aggregate. The gravel plant inspector submits a weekly composite grading sample to the laboratory which is used to check the field operations.

★ Subbase must be firm to carry mechanical spreader—a desirable feature

Construction Pitfalls

The discussion of construction practice is beyond the scope of this paper, however, there are certain pitfalls which must be avoided. Usually, these have been attributed by the inexperienced observer to faulty design or inspection of the stabilized mixture, when in reality, the pitfalls have been caused by the environment under which the mixture has been placed.

(1) Stabilized base course materials should not be placed over high capillary soils without an adequate subbase or other type of capillary cutoff.

(2) Stabilized material should not be used as a maintenance material to patch spring break-up areas. The excess moisture caused by the thawing of accumulated ice lenses will not allow the stabilized material to compact sufficiently to furnish the temporary bridging required to carry traffic over the failed area.

(3) Stabilized material should not be placed in continued wet weather in areas subject to traffic. The soil fines will be brought to the road surface by the action of traffic, and the surface will remain rutted and appear to contain an excess of binder soil. If the material is placed during the rainy season, traffic should be detoured and the material laid toward the plant to avoid construction traffic. After the drying period occurs, the road may be opened to traffic and continuous maintenance used until the road has been compacted satisfactorily. This ordinarily is not a long period.

(4) Stabilized materials should not be compacted in more than 3-in. layers. When thicker layers are compacted considerable warping of the surface alignment may be expected. The mechanical spreaders usually used for black top construction give very satisfactory results in the placement of a stabilized material with optimum moisture. In this case, the compaction period will be shorter and the use of side forms can be eliminated. The construction practice is similar to the type used for black-top construction. This method also is desirable because the subbase must be firm to carry the mechanical spreader.

Sand Subbase Needs Special Treatment

(5) Sand subbases used for capillary cutoff over objectionable soils or light sand subgrades, usually require

special treatment of the top 3 in. before placement of stabilized bases. A sandy clay or other suitable binder soil should be added and manipulated into the surface to form a firm base to carry construction equipment and insure a good subgrade and uniform thickness of stabilized material during placement. If the loose sand subbase or subgrade is not given this preliminary treatment, poor consolidation, non-uniform thickness of stabilized material and a distorted surface can be expected because of shifting of the subgrade during placement and compaction of the surface material.

(6) A compaction period of not less than two months of dry warm weather usually is required before bituminous surfaces can be placed satisfactorily on stabilized bases. Generally it would be more satisfactory to place the bituminous material the next season.

(7) The placement of stabilized materials should be restricted during the periods of spring and fall rains. During these periods the stabilized material should be stockpiled.

(8) If stabilized material has been placed over a frozen subgrade, load restrictions should be enforced rigidly during the spring thaw. Careful control during compaction should be exercised and weaknesses repaired immediately.

(9) The crown for stabilized surface courses should not be less than 5 in. for a 21-ft. road, if it is expected to serve adequately as a wearing course during the wet seasons (spring and fall). A flat crown will develop excessive pitting of the road surface from the action of traffic during wet weather. If a base course is to be carried over the winter, provision should be made to increase the crown during the fall, winter and spring seasons of the year. The reduction of crown should be made during the late spring and allowed to compact thoroughly prior to the placement of a bituminous surface.

(10) Adequate side ditches and well-shaped shoulders should be required for stabilized surfaces. When a snow removal problem is involved the snow should be moved outside the drainage ditch. The temporary high water caused by melting snow will, if not allowed to drain to the side ditches, cover the road surface and excessive pitting will result under traffic. This condition may cause a serious traffic hazard.

Payment on Weight

The Michigan highway department over a three-year period used stabilized materials at the rate of about 500,000 tons per year. During this period over 20 gravel plants and 10 stabilizers were used in the production of this material within the time limit allowed by the Department. Rigid inspection is employed in all production, and payment is on a weight basis to enable both the engineer and the contractor to arrive at accurate pay quantities without recourse to an extensive adjustment of bulking and compaction changes before they agree on the quantity specified in the contracts. All scales are checked by the department.

★ Uniformity is key to success of stabilization in Michigan

Pit Records Encourage Lower Bids

For economy in bidding, full use should be made of the complete inventory and analysis of the available local sources of material so that information as complete as possible can be given the contractors prior to receipt of bids.

In connection with the material survey, accurate records of previous productions from all sources should be kept in order to have full information on the areas in which aggregate productions may be difficult unless experienced inspectors are assigned to the project.

The specifications are based on the economical use of the better grades of local materials yet they are flexible enough to permit the use of a wide variety of stabilizing equipment and still insure uniformity of production of this type of material.

The design of stabilized mixtures has been simplified to permit the use of blending ratios, as determined by grading tests, to serve as the basis of controling the plasticity index of the stabilized materials. This design makes it possible to dispense with the usual physical soil tests required in the field to control the plasticity range of a stabilized mixture. The use of laboratory tests is chiefly for checking purposes.

The above mentioned methods used to *control the production and insure uniform materials are economical and worthwhile.* Increased production of the stabilizing plants by insisting that all materials shall be produced prior to the stabilization procedure has been accomplished without a material increase of stabilization since the increase in plant efficiency has compensated for the extra price which might have been expected for the stockpiling of materials.

In many cases the design of stabilized material has been blamed for causing trouble during construction, when in reality, the faults are caused by the environment under which it was placed.

In Conclusion

Although these data and stabilization methods presented are for Michigan climate and materials, it is felt that the general principles which have been given will cover factors which are encountered in many other states. Deviation from Michigan standards and practice is expected, for progress in any locality is made by modifying existing standards or methods to meet specific needs.

The Michigan requirements for inspection of low cost road materials may be more rigid and extensive than those of other states; but experience with both periodic and continuous inspection for variable materials has shown that the quality and performance of materials produced under rigid inspection will far more than offset the immediate savings derived from less rigid methods.

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Between V-J Day and the end of 1945 the New York State Department of Public Works awarded 44 highway construction and reconstruction contracts amounting to $12,750,000. The 1946 goal has been set at $150,000,000 more.

EDITORIAL

★ Why Be a Highway Engineer?

Down in Oklahoma City the state highway leaders talked about many things but none so vital as that of —guess what—pay scales for highway engineers. Commissioner Thomas H. MacDonald's message to that gathering, published in this issue, states facts which call for real action in most if not all of the 48 states, to say nothing of counties and cities.

The blunt fact is that highway engineering is competing poorly today for the new engineering talent on which reconstruction of the nation's highway system must depend. One engineering school leader recently is quoted as saying that not only are the best civil engineering graduates turning to other fields, but returning veterans and others entering engineering colleges aren't interested in taking up highway engineering.

Salary rates are only part of the problem, of course. Security, chance for development and advancement, freedom from politics, inspiring leadership—all these are things a young man hopes to find in the field of endeavor or organization he joins.

Some salary progress is being made. As a straw in the wind, North Carolina recently raised its highway department salary schedules, many of the raises ranging from $300 to $600 annually. Certain other states, counties and cities have also come through. But higher raises than this are needed in many places to bring salaries to where they belong.

Critical as the immediate need is for men in all grades including survey, inspection and test personnel, we aren't thinking just of today's transitory shortage. What of three, five and ten years hence? Will the multi-billion dollar highway program be manned by bottom-rung engineers? Or can we hope to build a new generation of career men from the cream of the crop—and who else are a match for the tremendously complex problems of economics, planning and management represented in expressway development, or for the tricky, complex technical fields of soils, concrete, asphalt and what have you.

As was also pointed out at Oklahoma City, able highway leaders as a group have grown ripe in years since World War I and a new generation will be stepping in. We can think of no more inspiring field of endeavor to challenge a young man today. Or a more urgent problem for legislative or policy action to be pushed by present highway leaders. Road departments must attract and hold able young career men, in spite of the keen new competition for manpower.

★ Congress Is Watching Us

As was so forcefully brought out by both Gen. Fleming and Mr. Upham at the ARBA meeting, the funds which Congress has made available for highway planning and construction present a challenge as well as an immediate problem to everyone who is in any way connected with getting the highway program under way and completed. The future stake of road-builders in the outcome of the present program is so great that they should leave unexplored no possible means of speeding it up. Construction labor especially would also seem to have as great a stake, as any serious failure in this program can only mean a curtailment of future programs if the Congress follows its traditional policy of basing the amount of future appropriations on the need shown for such funds by past accomplishments.

★ Force Account on F. A. Secondaries

Should contract construction, with the economy and efficiency that can come only under the whip of competition and private initiative, be required on all Federal-aid secondary projects? Or can county forces step in at times? A sensible statement of policy has been made by the PRA in its General Administrative Memorandum No. 297. Force account work will be approved when the projects are basically unsuitable for contract handling (such as certain light grading, culvert replacements, stage construction), and when the county can handle the work in normal stride.

Also it is stated that the cost must be reasonable. Here, it seems, is a chance to gather needed data on the relative cost and efficiency of force account versus contract work on secondary roads. Perhaps new "control sections" can be established for this purpose.

★ Good Highways Pay

(Ed Favel in The Indianapolis News)

Some rather significant figures have been compiled by the state highway commissioner of New Jersey, who has been studying the relation between good roads and population trends. He discovered that between 1910 and 1920 northern New Jersey's population increased more rapidly than that of southern New York. Between 1930 and 1940, however, after New York had completed some 300 miles of parkways, the growth east of the Hudson was three times that of northern New Jersey.

"In other words," points out the New York Times, "people tend to settle in regions where there are swift and safe traffic arteries for their automobiles, offering quick and easy access to commercial, recreational and residential centers."

There is a moral here for metropolitan Indianapolis, plagued by bottlenecks and traffic hazards on almost all the thoroughfares leading to the downtown area. Indianapolis can not continue to grow as it should unless free access to its popular areas is provided by arterial, limited access highways. Indianapolis has long since outgrown its horse-and-buggy traffic pattern.

..[The foregoing editorial is reprinted as an example of the new postwar version of the Good Roads Gospel. It is specially significant because too many of our cities are still in the political-fight or brave-talk stage in their plans for modernizing arterial traffic facilities.—EDITOR]

★ Our Choice to Win, Place and Show

It is a very natural tendency not to become too concerned about the things that get in the other fellow's hair. It is a different story when your own hair is involved, particularly the short variety. Makes you want to holler, "Why doesn't somebody do something about it?"

That is just what we are going to do; try to find out why somebody doesn't take the brakes off the heavy equipment industry so we can start writing up some of those super postwar projects for which money and plans are available, but which are stymied largely for lack of equipment. The welfare of the manufacturers, distributors, contractors, engineers, and public officials is directly connected with any regulations which affect the normal flow of equipment and materials into the construction field and that is where we come in.

We go along with the government 100% in their effort to control the prices of commodities which affect the cost of food, clothing, shelter, and the other necessities of life. We cannot, however, stretch our imaginations far enough to include heavy equipment in the same category with bread or rents.

Conceivably the price of equipment will rise if the government releases its price controls. We cannot see why anyone need be very concerned about that except maybe the people who engage in black market activities. The increased costs as reflected in bid prices will be undetectible and might even allow contractors to quote lower prices because they then have something they can bank on. Our money rides on *supply*, *demand*, and *competition* to win, place and show in the race that would result from any such far-reaching action as the lifting of all price restriction on contractors' equipment. Frankly we are impatient to see the wraps come off of some of the new models and there is nothing like competition to bring out the best. What is keeping the postwar era from being the hustle-bustle, slam-bang, rip-snorting time that we had dreamed of all those war years? Price control of heavy equipment is our nomination for reason number one.

It is also a natural thing to be somewhat selfish, but in trying to be reasonable we can see that the construction industry cannot enjoy special privileges. What is good for us will be good for a lot of other industries, so this is the thing we advocate. Remove price control restrictions from each and every item which is not clearly a necessity to the life and well being of each individual and combine price control and rationing to prevent inflationary price rises in the cost of consumer necessities. In our opinion, rationing will prove more effective than price control if properly administered and enforced. In other words, insure us all something to eat and wear and a place to sleep and then if we want to pay someone a good profit for things we can take or leave alone that is our business. At least such choice items will then be available which is more than can be said right now. Who knows, maybe we editors of 'Roads and Streets" could buy a new car or two then to go look at the big jobs we are so sure would soon be under way. Even a new house comes within the realm of possibility if they will just let *free enterprise* and his running mates, *supply*, *demand* and *competition* out of the dog house.

Road Builders' Convention

ARBA's annual convention at Chicago spotlighted technical and safety problems and developments in methods and equipment. "Refresher" training of returned service men advocated to get needed personnel. Serious lag in beginning of postwar program and current high bids failed to dim "rarin' to go" attitude on the three-billion-dollar program ahead

DESPITE the shortage of hotel accommodations, Chicago did a grand job of playing host to the 43rd Annual Meeting of the American Road Builders' Association held January 14 to 17, at the Stevens Hotel. This first postwar meeting of ARBA provided a much needed opportunity for the discussion of plans and the exchange of ideas and information between the nation's leading contractors, engineers, equipment manufacturers, and public officials.

The seriousness with which these men take the problems confronting them and the country during this reconversion period was everywhere in evidence. It was the unanimous opinion that the three-billion-dollar federal highway bill is a challenge to the industry rather than any reason for the least bit of complacency. There was a full realization that failure to complete this three-year program on schedule could very well result in smaller road appropriations by Congress in the years to come.

A summary follows of some of the many papers, committee reports and informal comments:

Manpower Training, Key Problem

Charles M. Upham, engineer-director, helped keynote the convention by calling attention to the current serious shortage of design, survey, field testing and inspection personnel. He pointed out that never have our highway departments needed experienced personnel as badly as they do today. War casualties, wartime changes in occupation, and the small number of engineers graduated from our colleges recently, account for the shortage. Without the services of an ample number of trained engineers, highway projects cannot be contracted for in sufficient quantity to take full advantage of the funds now available.

A manpower answer was presented in the form of a program of cooperative refresher courses for ex-Army engineers and Seabees, an idea which has met with the approval of several highway department heads and deans of engineering schools to date. It will be a short-sighted policy which does not tap this immense reservoir of "know how," observed Mr. Upham. These men need only a minimum of basic training to make them as effective in peace as they were in war. Such a training program might go far in alleviating the shortage of engineers, while at the same time helping a great many ex-service men to be more content with their postwar lot. The ex-service men are interested; the next move is up to the public officials.

About High Bids

A twin "keynote" was the need to speed lagging road programs. The reluctance to award contracts at current bid price, evidenced by some public officials, is a serious source of delay. Mr. Upham again [See Dec. R&S] cited the fallacy of taking 1941 prices as a yardstick in determining when current bids are too high. He called attention to the fact that the last "normal" period existed between 1925 and 1929, with 1927 representing the average. 1941 prices were only 81% of 1927. On the basis of this logical analysis, bid prices as much as 35% to 40% above 1941, can still be considered as representing only a reasonable price advance.

To Woo Public

Among ARBA's new activities is the formulation of a public relations program, to sell the highway industry and the public alike on the fundamental importance of modern roads to the nation. The new Public Relations Division is mapping plans for carrying out this program through the technical and general press. The possibilities offered by the use of advertising methods such as posters, themes and slogans is being investigated, as is the launching of a nationally circulated magazine.

Greater Safety

The interests of the general public were kept constantly before the delegates through discussions of the need for designing safety into highways.

Among the Speakers and Discussion Leaders at the Road Builders' Meeting:

James J. Skelly | Lieut. Gen. R. A. Wheeler | Ray B. Traver | Prof. G. P. Tschebotarioff | Prof. A. Diefendorf | Spencer Miller, Jr.

Traffic fatalities and their continued challenge to the road builder to build greater safety into the highways were discussed by Spencer Miller, Jr., New Jersey highway commissioner. All accident forecasts have been far exceeded since the war and the accident rate is still going up. Mr. Miller pointed out that auto design improvements and new enforcement and educational steps must be reinforced by highway modernization. Among fundamental design features reviewed by Mr. Miller for highways subjected to heavy and fast traffic, are lateral separation of traffic; elimination of highway and railroad grade crossings; wide, smooth, level shoulders; controlled access (to restrict ribbon development of homes or businesses); and proper directional signs. He stated his belief that proper highway design can reduce the causes of accidents by 79%. The remaining 21% can then be brought to an irreducible minimum by law enforcement and education.

Several other speakers also dwelt on the grave and urgent need for safe design and for a large increase in the employment by public agencies of traffic and safety experts.

Broad Aspects

The basic relationships on which the federal-aid highway program is so soundly built, were reviewed by Congressman J. W. Robinson (Utah) during a session devoted to broader highway aspects. Principal controls: the federal government deals only with the states, for local flexibility and separation of Washington from local affairs; all projects are initiated by the states; engineering standards are required to match traffic demands for each road class (modified on secondaries to fit physical and financial limitations); federal funds are available only to road designated on connected systems; 50-50 federal participation.

Congressman Robinson stated that Congress depends on ARBA for facts pertaining to highways. He stressed the important bearing highway construction has on the nation's well-being and brought out that traffic accidents are focusing public opinion on the state and local governments responsible for carrying on road programs.

Congressman Robinson concurred in a recent statement by Sidney J. Williams, assistant to the president, National Safety Council, that the MacDonald report on Interregional Highways is the greatest single contribution ever made to highway safety. The 40,000-mile Interstate System, although containing only about 1% of the total road and street mileage, will carry 20% of all highway traffic when completed. It passes through all cities of 300,000 or more, and through more than half of cities of 10,000 or more. It will be built

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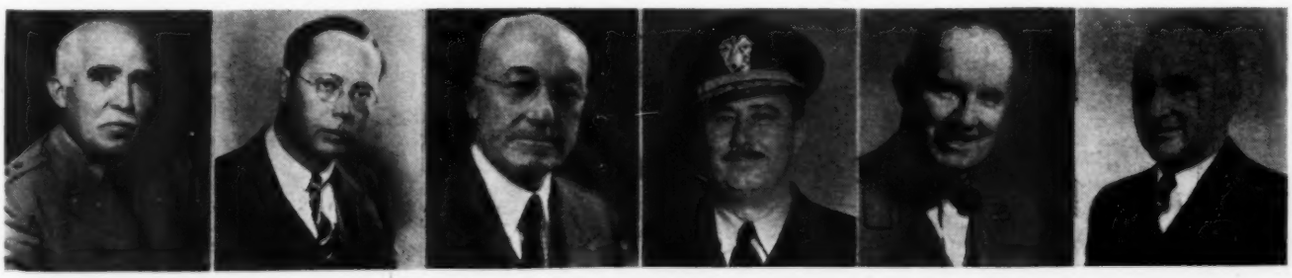


Maj. Gen. Philip B. Fleming | Wm. A. M. Burden | Julian L. Schley | Comm. R. B. Jennings | J. T. Callaway | W. Bruce Chilson

★ (Left): Congressman Jennings Randolph (W. Va.); ARBA pres. James J. Skelly; Congressman Jesse Wolcott (Mich.): (Right): Spencer Miller, Jr., highway comm'r., N. J.; Congressman J. W. Robinson (Utah); Thomas H. MacDonald, commissioner of public roads.

★ Robert B. Brooks, consulting engineer, St. Louis; (two unidentified); Chas. Smith, Pensacola (pres. ARBA contractors div.); J. T. Callaway, Goodyear Tire & Rubber Co.

★ Mexico's distinguished visitors: Gilberto del Arenal, director general of highways, and Francisco Rodriguez Cabo, chief of maintenance, Mexican department of communications; Prof. A. Diefendorf, U. of Utah; Nathan Smith, Baltimore

to the highest standards of safety consistent with traffic needs. "Certainly, when we can save the lives of so many people and serve so much traffic with such a limited mileage, every effort should be put forth to bring about the early completion of this vital system," asserted the Congressman.

Program Too Big?

But in different vein Congressman Robinson warned, "Congress is guided by two things: by the need for highway improvements, and by the ability of the highway departments to execute construction. The highways themselves stand as proof of need. Only the construction volume can testify as to whether Federal-aid should be continued on its present basis or reduced. Failure to carry on the program successfully on each of the three classes of roads, i. e., the Federal-aid highways, the urban extensions and the secondary roads, will jeopardize the entire future program."

As future warning, Maj. Gen. Philip B. Fleming, Administrator, Federal Works Agency, stated that forecasts for activity in the highway field are dropping regardless of the fact that state highway departments have done a very good job of plan preparation. He stressed the importance of holding the price line and stated that the Government should not be a party to a rising price level that will choke off needed public construction, or lead directly to inflation.

Further regarding the lag in construction, Gen. Fleming said, "There are several obvious reasons why public construction is lagging. Lack of material is one cause, but not the main one. Highways, for instance, would take less than 1% of the brick and lumber expected to be produced this year, and practically none of the other critical materials, such as soil pipe, insulating board, gypsum board, clay tile, heating and plumbing. Shortage of skilled labor is a much more important cause, and that is accompanied by general uncertainty as to the future of costs, including the costs of labor and materials. As long as there is uncertainty as to whether such prices are going up, contractors will hesitate to make fixed commitments extending many months into the future. This phenomenon is not peculiar to the construction industry; but the construction industry—and the public section of it particularly—is especially sensitive to this general uncertainty as to future price trends."

Advised Gen. Fleming, "Well-prepared plans are the least expensive plans. The cost of planning may run to no more than 4 or 5% of the cost of the planned construction, but only if the plans are carefully prepared well in advance. Plans carelessly hashed together in a hurry to meet a critical need for employment—as were many produced during the depression of the '30's—plans that have to be revised and improved while construction is already underway, can be mighty expensive and result in expensive structures."

Greater Cooperation on Urban Job

W. W. Polk, Illinois highway chief, restated the need which has always existed for cooperation between all public agencies involved in highway and city street construction. The need he finds, becomes very apparent where highways join city streets or enter urban areas. He cited the Chicago and Detroit expressways as excellent examples of the results cooperation can produce.

Lt. Gen. Raymond A. Wheeler, Chief of Engineers, outlined three important parts the U. S. Army Engineers can play in the postwar construction program: (1) use of wisdom in helping put to use the accumulate stocks and future production of American road-building equipment; (2) pressing with the greatest

urgency a list of projects designed to catch up the "lag" precipitated by the war; (3) and, most important, research and experience.

It was also evident from a paper on the subject, "Soil Testing for Military Construction," given by Col. Henry J. Hartner, Office of Chief of Engineers, that civilian public works can gain much from the methods and practices developed by the military agencies on wartime construction projects.

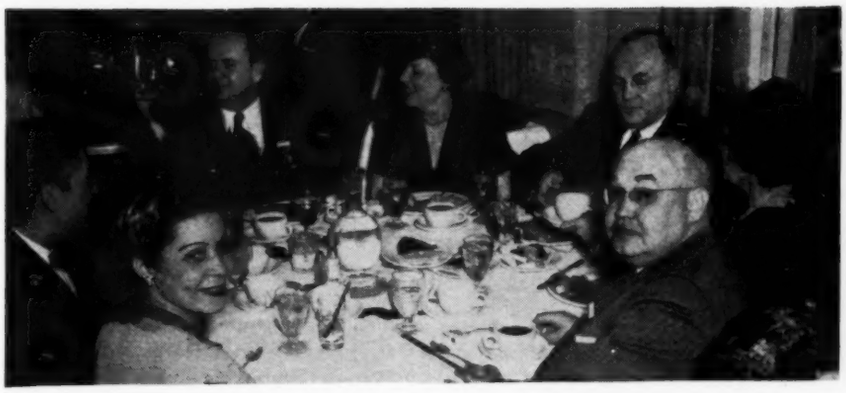
Local Road Outlook

The 1946 ARBA meeting was strongly represented by county men, and their feelings were well set forth by Arthur F. Ranney, county engineer, Summit County (Akron), Ohio, in his paper on "Administration of the New Federal-Aid Highway Act from the County Standpoint." Some of his remarks:

"As I view this program of Federal aid to counties, it is new and untried, yet it can be the beginning of not just a three-year postwar program, but of a continuous policy for the improvement and administration of local roads.

"I wish now to make an appeal to all state highway departments, the PRA and local officials to exercise patience in formulating the program. We know that state departments have been operating with Federal aid for many years, but, at the beginning, most of them were no better prepared to meet the regulations than our counties are today. I like Congressman Robinson's explanation of the situation, when he said, 'We are embarking on a shake-down cruise, where the weak points of a vessel are always detected and corrected, if possible.' I feel that officials of Federal, state and local governments should act as the officers of the ship on this voyage and aid, wherever possible, to remedy the defects in the program, so as to produce the best final results."

★ Charles M. Upham



★ Mrs. and Mr. H. S. Pulido, with Cuban Minister of Public Works; Mr. (and Mrs.) E. S. Gillette, Publisher of "Roads and Streets"; Mr. and Mrs. Hal G. Sours, Baldwin & Sours, Columbus; Prof. A. Diefendorf, Univ. of Utah

★ L. P. Bowman, Southeastern Sales Co., Harlan, Ky.; (Wm. N. D. Fischer, of Baltimore, and V. H. Nixon, Rogers Iron Works (cut off at left); L. H. Koenitzer and Joe B. Britton, Mo. School of Mines; Geo. E. Martin, cons. engr., Barrett Corp.; Ray Williams, supt., Saratoga County, N. Y.; Earl F. Bennett, principal soils engr., N. Y. State

The prime need for cooperation via the states also exists in the newly established Federal-city relationship, observed Nathan L. Smith, Pres., Municipal Division, ARBA, who is chief engineer, department of public works, Baltimore. From his talks with other municipal officials, he has gathered the impression that most cities are handicapped by lack of funds, high taxes on real estate, and limited income from other sources; while, on the other hand, the State governments are well supplied with funds. He held forth hope that through ARBA's assistance in the interchange of information on various plans for financing construction and maintenance programs, many cities will be able to match federal funds and also carry on a more extensive program of local improvements.

Technical Sessions

The technical sessions served to highlight the vast amount of research performed and engineering knowledge gained in the accomplishment of wartime grading and paving projects. This aspect supplemented by several excellent papers dealing with design and maintenance of our public roads and streets made these sessions of special interest to road-builders in all categories. Earl F. Bennett, principal soils engineer, N. Y., and Carl E. Vogelgesang, chief engineer, Indiana, presided over the technical sessions.

Soil Compaction

O. J. Porter, materials and research engineer, California, in a slide talk on "The Use of Heavy Equipment in Providing Maximum Compaction of Soils," gave his listeners an insight into the types of equipment which can be expected to come into prominence in the postwar era. Mr. Porter observed, in part:

"It is important to consider the factors that must be taken into account in compacting soils. The soil must be properly moistened so that the energy expended will force the grains more closely together. In order to compact the soil it is essential that the air be expelled. The rate at which the air can be expelled is influenced by the thickness of the layer. . . . The usual cry is, of course, that

compaction is difficult to obtain and therefore we have specified a degree of compaction that is more practical. With heavy soil types, such as clay, it is essential that we use thin layers to obtain a maximum compaction. If thicker layers are used, energy is wasted. . . . California requires compaction to a depth of 3 ft. below subgrade in both cuts and fills. . . . Much progress has been made, but much remains to be done."

In Porter's opinion, much money can be saved both in compaction and in paving costs by making a careful study of test sections on the project prior to specifying the degree of compaction and the manner in which it will be accomplished. It may often be much cheaper to compact thin layers rather than follow out the natural tendency to go to as thick a layer as possible. . . . Tire pressures in the new airplanes are due to go up—110 lb. in the near future, with 200 lb. and over predicted. Mr. Porter gave credit to ARBA for its very good progress in the soil compaction field as well as in other highway technical studies.

Vibratory Compaction

Speaking on the subject of "Vibratory and Impact Compaction of Soils," Prof. G. P. Tschebotarioff, School of Engineering, Princeton University, indicated that research in this field had so far brought out the practical limitations of such methods rather than indicating recommended practices. Conclusions reached by Prof. Tschebotarioff:

(1). Rollers of different types are likely to remain at present the most efficient type of compaction equipment for all cases where the fill can be placed and successively compactd in layers.

(2). For clay soils there definitely is no advantage in using vibratory soil compaction equipment, but in certain cases there may be some advantage in using impact producing types of such equipment.

(3). The economic advantages of using vibratory or impact types of compaction equipment, acting against the surface of a sand layer or deposit, are not immediately apparent, although they may achieve the technical results desired.

(4). The compaction of deep, loose, natural sandy deposits, or of hydraulic fills, beneath airports designed for planes of 50,000-lb. wheel load or more, is a problem in a special category. Conventional methods of compaction by loads acting on the soil surface are not likely to be efficient. A possible solution lies in the use of new types of machinery built along the lines of a "multiple sand-pile driver," or a "multiple vibro-flotator." The former could be used in any sandy soil, irrespective of its clay or silt content. The latter probably would have to be limited to clean sands only.

Soil Stabilization

Bearing out the thoughts expressed at ARBA's meeting a year ago by W. A. Roberts, vice-president of Allis-Chalmers, soil stabilization appears destined to play a leading role in postwar developments in the road field. [A highly informative paper on the value of stabilized roads in the highway program, by Charles M. Ziegler of Michigan, is reproduced in this issue of "Roads and Streets."]

The need to consider three clear aspects in discussing county road stabilization was stated by County Engineer G. W. Deibler of St. Louis County, Minn. These are: design and construction of a combined stabilized base and gravel surface; stabilized gravel base for the support of a pavement of either the flexible or rigid type; and stabilization or consolidation of an existing sand or gravel surface. He also expressed the opinion that the stabilized road belongs at or near the top of the list of the essential requirements for the future improvement of our county highways.

Mail Inserted Card for Equipment Data

Again this issue of *Roads and Streets* carries descriptions of many new labor-saving efficiency devices and latest material developments. See our Postwar Parade beginning on page 113, for which a numbered reply card has been inserted to help you request data on items that interest you.

Paving Joints

Three factors are always present when pavement joints pump, reminded F. F. Havey, engineer of tests, Indiana. These are: traffic, water, and soil. Since little can be done about controlling rainfall or volume of traffic, a study of pavement design and soil treatments must supply the answer. The problem can be minimized, or eliminated by use of granular subbase material. Indiana experience shows that thickened edges and load transfer devices have little to do with pumping. Mud-jacking has been found by Mr. Havey to be a most effective means of remedying joints which have started to pump. He has secured a large amount of data from flow tests and tests of durability of mud-jacking material. Mr. Havey ex-

★ (Left): J. N. Heintz, v.p., C. S. Johnson Company, with William B. Catchings, maintenance engineer, New Mex., and O. J. Porter, soils expert, Calif. highway commission. (Right): J. W. Thompson, vice president of the Carolina Road Builders, with Mr. (& Mrs.) Nello Teer of eastern road building fame

★ Mostly Civil Aeronautics men: Francis Halloway (left foreground), H. Adams, M. Alpows, A. L. Wait, William Slee, William Catchings, Harry Seaman (Seaman Motors), and Phil Moore

pressed doubt as to the effectiveness of longitudinal side-drains because of the probable clogging effect muddy water would have on the porous backfill. The use of a hydraulic jack has been helpful in raising broken slabs during mud-jacking operations.

Mr. Havey was followed on the program by Prof. K. B. Woods, Joint Highway Research Project, Purdue University. Prof. Woods continued on the subject of pumping, using moving pictures to illustrate points brought out by Mr. Havey. The pictures showed the absence of pumping on pavements having proper subgrade treatment. Prof. Woods brought out that considerable danger to workers is involved in pumping hot bituminous material under pavements due to the extreme pressure required to raise the sunken slab. The pictures illustrated the progress his group had made in developing an "easy-to-operate" hydraulic jack for raising the slab prior to pumping. The danger connected with the pumping of bituminous materials is greatly reduced where a jack is used to raise the slab.

Maintenance

"Importance of Prompt and Continuous Maintenance," was the subject of a challenging paper by Prof. Ben H. Petty, of Purdue University. While maintenance has various meanings, Prof. Petty feels that its prime objective is to protect the investment and keep down costs to the public. He favored putting first things first and rightly advocates that the road surface is of most concern. Roadside developments at the expense of the road surface are not warranted in his opinion. Maintenance performed at the proper season of the year, after a thorough and adequate inspection has determined the extent of the surface treatment needed, is his advice. Prof. Petty strongly urged that expansion joints be eliminated except at bridges and similar solid structures. He pointed out that stabilization is the answer to the rapidly dwindling supply of gravel. Calling maintenance a specialized field, he took the politicians to task for being so shortsighted as to replace experienced maintenance men with political appointees.

Planning Need

The value of long-range planning was brought to the foreground time and again during the meeting. Many speakers apparently found it impossible to develop fully the topic assigned to them without discussing the important part planning played.

George H. Field, Commissioner, FWA's Bureau of Community Facilities, appeared before the Municipal Division meeting to outline the extent and purpose of the 30 million dollar appropriation Congress has made available for planning.

Daniel O'Flaherty, Highway Economist, FWA Division of Highway Transport Research, used slides to illustrate a highly informative talk on "Evaluating Urban Traffic Problems by New Techniques."

A plea for coordination of the activities of the various agencies preparing plans for such urban developments as schools, streets, railways, sewers, and other public works was voiced by Herschel H. Allen, Pres., J. E. Greiner Co., of Baltimore.

Pan-American Progress

A noon luncheon provided the setting for a report by Chas. M. Upham, on the inter-American highway training program. Following this report, Sr. Francisco Rodriguez Cabo, chief of maintenance, Dept. of Communica-

Pan-American Award at the Banquet

After introducing the distinguished guests, Mr. Upham called on Maj. Robert Roach to explain the Pan-American Award for Outstanding Achievement in the Development of the Pan-American Highway.

Maj. Roach explained that 3,250 miles of this highway lies in Mexico, reaching from Laredo to Panama City. He pointed out that the Board of Directors of ARBA decided to present the award to someone from the outside—someone who had done an outstanding job.

Hon. Paul Cunningham, U. S. Representative from Iowa, member, House Roads Committee, made the presentation to Thomas H. MacDonald, Commissioner, Public Roads Administration, Federal Works Agency, the North American recipient, and to Sr. Montes de Oca, President, Banco Internacional, S. A., and Honorary Life President, Asociacion Mexicana Automovilistica, Mexico, D.F., the Latin American recipient. In the presentation to Mr. MacDonald, Congressman Cunningham praised him for his splendid leadership in building up the nation's highway system. He called attention to the national and international acclaim which Mr. MacDonald has received for his outstanding accomplishments.

In accepting the award, Mr. MacDonald said that he did so only as a trusteeship. He called attention to the fact that the splendid progress made on the Pan-American highway came about through the cooperative effort of a great many people, both in Mexico and the United States. Mr. MacDonald predicted that three years and more money will be required to complete the Pan-American highway.

Mexican Program

Since it proved impossible for Sr. Montes de Oca to be present, Gilberto del Arenal, Director General of Highways for Mexico, accepted the award in his behalf. Speaking in Spanish, he reiterated Mexico's intention to complete her portion of the highway with the least possible delay regardless of a shortage of equipment and repair parts. Sr. Francisco Rodriguez Cabo, chief of maintenance, Dept. of Communications for Mexico, translated Gilberto del Arenal's remarks for the audience.

An address by Honorable Jennings Randolph, member, Committee on Expenditures in the Government Departments, U. S. House of Representatives, on the subject "Our Hydra-Headed Government" followed the presentation.

★ C. H. Buckius, Allegheny Asphalt & Paving Co., Pittsburgh; Paul Reinhold, Atlas Equipment, Pittsburgh; A. McMillan, Chain Belt Co.; Glen Maxon, Maxon Construction Co., Inc., Dayton, Ohio; A. E. Miller, Chain Belt; A. E. O'Brien, ARBA Contractors Division; Murray Shaffer, consulting engr., Columbus, Ohio

tions, Mexico, D.F., told of the value of the Pan-American scholarship program. Sr. Cabo, having received training under ARBA's scholarship program some years ago, was himself an example of the theme of his talk.

Gilberto del Arenal, Director General of Highways, Mexico, D.F., in his talk "The Highway Program of Mexico for 1946," stressed Mexico's intention to complete her portion of the Pan-American Highway with the least possible delay. Mexico's 40 million dollar road program for 1946, is the largest in its history.

3000 New Airfields

ARBA's airport session was keynoted in a paper by Maj. Gen. Julian L. Schley, Pres., Airport Div. of ARBA, who is executive director of the Baltimore City Aviation Commission. General Schley called attention to ARBA's long participation in airport matters and expressed its interest in the extension of the federal airport program.

William A. M. Burden, Ass't. Sec'y., Dept. of Commerce, cited the need for 3,050 new airports and improvement of 1,625 existing airports, but also made it clear that these figures were not intended as a maximum. After explaining the differences between the bills passed by the house and the senate, Mr. Burden expressed hope that some acceptable compromise on these bills will be reached in time to allow construction to go forward in the 1946 construction season. He urged the road builders not to remain idle, but to plan their share of the program and to make it clear that they believe rapid action is imperative.

W. E. Cullinan, Jr., Dir., Bureau of Aviation, N. Y. State Dept. of Commerce, gave the road-builders some down-to-earth advice on airport design. His talk on "Some Design Requirements for Airports," told of the need for careful site selection, full consideration of all factors affecting runway and taxiway layout, and the giving of full weight to economic aspects when the master plan is being prepared. Mr. Cullinan said in closing, "Entering this new era of airport development, I am more concerned that the general airport design (a) be economically tailored to fit the local aviation needs of the community with a maximum of utility and safety, (b) fit into a coordinated state and national system of airports, and (c) planned on a site that will not have to be abandoned or restricted to limited operation in the future."

"Municipalities' Obligation Concerning Operation and Maintenance of Airports," a subject of vital interest to municipalities, was discussed by J. Kirk Baldwin, Gen. Mgr., The Airport Directory and Airport Consultant, Airports Magazine.

Experience gained in placing 90,000,000 sq. yd. of pavement in the seven states of the South Atlantic Div., U. S. Engineer district, provided the background for an enlightening slide talk by Burton J. Bell, Chief, technical information branch, of this division. Pavement surfaces have been only as good as the bases under them, was one of Mr. Bell's observations. Good compaction and adequate thickness have proved to be two musts.

That airports and airport service stations will render a growing service and be an important part of community life was brought out in a talk given by Aubrey Keif, Manager, Aviation Sales, The Texas Co.

Mr. C. C. Todd, Chief, Roads, Runways and Railroad Section, Maintenance and Service Branch, Headquarters, Eighth Service Command, U. S. Army, Dallas 2, Texas, spoke on the subject, "Equipment and Methods for Maintaining Airfields." [See Oct., 1945, R&S for extensive report on this same activity.]

Money Problems

The impression was gained that, while finances are extremely important to all officials dealing with road-building, the problem is more critical in relation to municipal projects than it is to the states and counties. Mayor Ralph B. Slippy, Waterloo, Ia., read to the Municipal Division committee on street and street railway construction and paving, a report sent to the Governor of Iowa, prepared by the Iowa State League of Municipalities working in conjunction with a committee of representatives of ten Iowa cities. This report seemed to so nearly typify the general situation and thinking of municipal officials that it is reproduced in this issue.

Equipment for the Postwar Highway Program

By J. T. Callaway
President, Manufacturers Division, ARBA, and Asst. to the Vice President, Goodyear Tire & Rubber Co.

OUR $3,000,000,000 Postwar Highway Program is the No. 1 identifiable item in a multi-billion-dollar backlog of general construction. The availability of funds must depend upon State collaboration, but the execution of highway contracts will depend, in great measure, upon the availability and efficiency of construction machinery.

The evolution of building equipment dates from the one-man, one-yard hand-scraper, when the power unit was one mule in the flesh. The cat-skinner of today and tomorrow may drive teams ranging as high as 500 diesel horses. We have majored in a never ending array of accessories conceived, developed and economically produced in the light of Mr. Contractor's costs. From the smallest pump to the largest crane, pneumatic traction and flotation has g r a d u a t e d speed, capacity and longevity. The gruesome grind of war has generated a new high in mechanical guts.

Reconversion has not been simple and the reinstatement of normal development procedure has not been uniform. Nevertheless, our new peacetime stride is definitely in the making

(*Continued on page* 121)

★ W. E. Miles, Oliver Corp.; H. Gusman, pres., Wooldridge Mfg. Co.; J. D. Aldrich (and Mrs.), Seaman Motors; W. T. Brown, Florida; M. E. Adelstein, Northwest Engineering Co., Denver; H. W. Davis, Oliver Corp.; W. R. O'Brien, Great Lakes Supply Corp., Chicago; A. H. Telrick, Woolridge

★ Bigwigs at the AED Meeting: C. F. Halliday, C. F. Winchester, W. W. Bucher, Walter J. Kane, F. B. McBath, Wm. A. Danner, H. O. Penn

All-Time Record Attendance at

Distributors' Meeting

Over 1,400 machinery men swarmed to Chicago. Lively discussion topics included price controls, strikes, surplus property disposal, future delivery prices, trend from free enterprise, returning veterans, construction outlook, fair trade practices, credits

OVERSHADOWING all other events at the recent 27th Annual Meeting of the Associated Equipment Distributors at Chicago, of course, was the untimely death of its retiring president, Hamilton O. Penn. Mr. Penn's death, following a heart attack, was announced to the members during luncheon on the final day of the meeting.

The measure of the construction equipment industry's current vigor is revealed by the big attendance—an all-time record of over 1,400. The meeting was highlighted by excellent talks and papers by leaders of national prominence.

Taking a cue from the successful radio quiz shows, AED used this form of "question and answer" program to define and discuss the industry's varied problems. A panel discussion was participated in by: Hal M. Davis, vice-pres., R. B. Everett & Co. (Houston); Ralph S. Patten, gen. mag., Patten Tractor & Equipment. Co. (Chicago); George N. Beckwith, vice-pres., Beckwith Machinery Co. (Pittsburgh); Carl F. Oechsle, ass't. vice-pres., Worthington Pump & Machinery Co.; William Greene, pres., Barber-Greene Company; Julian R. Steelman, vice-pres., Koehring Company. These spokesmen brought out questions that are bothering members of the industry, and direct answers by qualified leaders.

President Truman's Message

President Penn read the following opening-session message from the White House:

"I am happy to greet you and the members of the Association of Equipment Distributors on the occasion of your twenty-seventh annual convention. I know that you are aware of the important part that manufacturers and distributors of machinery must play in the program of the construction industry and of the reliance that we have in your determination and ability to do everything possible to lower construction costs and to aid the construction program in every way."

On Machinery Prices

The primary question was, "When do we get firm prices on future deliveries?" More specific questions followed, including "What per cent of the existing backlog of a customer's orders represent duplicate orders placed in the hopes the one distributor or the other will be able to make the earliest delivery?" And "In view of the strike situation, how can a definite price be given that will hold?"

In reply to the primary question, Mr. Oeschle indicated that many factors outside the control of the manufacturers make it almost impossible to give equipment buyers an adequate answer. He said, "Government wartime controls are still being exercised over our entire economy and unfortunately Government actions are too often unpredictable. Government controls have their effect on prices, wages, profits, control of raw material and finished materials, and in the case of the automobile industry even reach into the field of arbitrarily setting distributors' re-sale discounts. All of these factors affect the ability

of a manufacturer to establish firm prices for any reasonable length of time."

Mr. Oeschle urged cessation of price controls by OPA on products of the capital goods industries. The price of these products, he observed, has a minor effect on the cost of living, as compared to consumers goods, and there would be a great stimulation to increase production. The time would then quickly come when the great leveler of prices—increased production and competition—would soon bring prices down to their proper level.

Quoting Mr. Oeschle further, "When and if OPA dispenses with price control on capital goods items, it should then be possible for all manufacturers of construction equipment to quote firm prices on future deliveries at least for a period of six months to a year. Therefore, it should be perfectly obvious to distributors as well as manufacturers that the answer to the question of this panel discussion is at present beyond the control of either the manufacturer or the distributor and it behooves both groups to get busy and try to do something about it in order to arrive at a solution."

Immediate Stabilization? No.

Mr. Greene, in answer to questions directed to him, indicated that only when conditions stabilize can manufacturers quote prices, and he believes this will not take place before July, 1946. He said that OPA feels that distributors' costs are too high and that OPA could not give AED any decision which conflicts with current policy.

Mr. Steelman, on questions relating to backlogs and labor costs, said he felt that no one today can tell which customers' orders are legitimate. Most manufacturers do not put too much stock in present orders, having too large a backlog now. In discussing the effect of strikes on equipment costs, he said that strikes are helping to keep the supply below the demand and that prolonged strikes will probably result in less construction being accomplished.

Pointing out that labor is the biggest factor in the cost of equipment when the costs of producing and processing raw materials are taken into account, Mr. Steelman made a strong case for giving more consideration to labor costs in setting up price controls. Stating that the government does not share his views, he called attention to the fact that manufacturing methods in the heavy industries have been stabilized for a long period of time, which differentiates them from the newer industries. Such savings as are accomplished by improved methods are more than offset by increased labor costs, which Mr. Steelman said is now approximately 40%.

The belief was expressed that "escalator" clauses in all contracts are a fair solution, and that these clauses should be in the distributor's sales contracts, as in those of the manufacturer.

Officers and Directors for 1946

President: F. B. McBath, Columbia Equipment Co., Portland, Ore.

Exec. Vice Pres.: William A. Danner, Parker, Danner, Inc., Hyde Park, Mass.

Vice Presidents: A. F. Garlinghouse, Garlinghouse Brothers, Los Angeles; C. F. Halliday, Western Material Co., Sioux Falls, S. D.; Walter J. Kane, Kane-Gibb-Marr Co., Winnipeg, Canada.

Treasurer: W. W. Bucher, of R. E. Brooks Co., New York.

Executive Secretary: C. F. Winchester, Washington, D. C.

Directors: William A. Danner Hyde Park, Mass.; H. J. Hush, Griffin Equipment Corp., New York; C. N. Crawford, C. N. Crawford Equipment Co., Pittsburgh; Robert Hill Carter, Virginia Tractor Co., Richmond; Albert E. Hahnan, Tractor & Machinery Co., Inc., Atlanta; Clare Williams, W. W. Williams Co., Columbus, O.; George W. Swart, Contractors Machinery Co., Grand Rapids; C. F. Halliday, Western Material Co., Sioux Falls, S. D.; James W. Bell, James W. Bell Co., Cedar Rapids, Ia.; H. L. Burleson, Browning-Ferris Machinery Co., Dallas; A. F. Garlinghouse, Los Angeles; F. B. McBath, Portland, Ore.; W. G. Clark, Tri-State Equipment Co., Inc., Memphis; Pat Norris, Wortham Machinery Co., Cheyenne, Wyo.; Walter J. Kane, Winnipeg.

1947 Road Show Plans

J. T. Callaway, Goodyear Tire and Rubber Co., prefaced a talk on "The Common Goal" by announcing preliminary plans for the 1947 Road Show of ARBA, which he said is to be held during the week of Feb. 17. Stating that the Navy pier in Chicago is the only building in the country large enough to do the show justice, Mr. Callaway said that a meeting held recently with navy officials and Senator Brooks resulted in the matter of the use of the pier being given top priority at a coming conference in Washington.

Surplus Property

John S. Cooke, vice-president, Consumers Goods Division of the new War Assets Corporation, claimed that

Seen at One of the "Open House" Gatherings

★ (Left): Wm. Grierson, Union Tractor & Equipment Co., Ltd., Edmonton, Alberta; Lamar Burford, Burford-Toothaker Tractor Co., Montgomery, Ala.; Paul Foley, Foley Tractor Co., Wichita, Kan.; Harry Toothaker of Burford-Toothaker. (Right): Chas. Yager and Roy Foster, Foster-Yager Machinery Co., Albany, Ga.; D. O. Nash, genl. service mgr., Caterpillar Tractor Co.

★ (Left): Jack Roasa, Martin-Roasa Tractor & Equipment Co., Cedar Rapids, Ia.; W. K. Cox, asst. genl. sales mgr., Caterpillar Tractor Co. (Center): Lon Dauer, v. p. and genl. sales mgr., Trackson, Co. (Right): E. B. Stribling, Stribling Bros. Machinery Co., Jackson, Miss.; J. D. Pittmann, J. D. Pittmann Tractor Co., Inc., Birmingham, Ala.; Goodloe Yancey, Yancey Bros. Co., Atlanta, Ga.; Fred Hill, Stribling Bros.; Harold Graves, Ohio Machinery Co., Columbus, O.

WAC's new policy will expedite surplus war equipment sales by giving greater authority to regional officials to promote and plan sales campaigns. Maintaining the policy of selling wherever possible under normal business practices, WAC have agreed to combine with RFC to hold sales at the various military depots where the merchandise is located. These sales, slated to begin soon, are aimed at quick disposal not only of declared but undeclared surplus items. Mr. Cooke estimated the equipment inventory to be over $300,000,000, most of it new. In order to comply with the terms of the act under which it functions, WAC must see that federal, state and local governments and veterans are given preference and that small business is afforded equal opportunity.

★ AED president-elect F. B. McBath greets H. A. Dick, president of Associated General Contractors

"On the Job" Program for Veterans

A. F. Garlinghouse, chairman of AED's committee on Employment of Discharged Veterans, placed the veterans in 4 classes, (1) returning to take over business, (2) previously employed by AED, (3) going into own business, and (4) seeking employment. Stating that AED is the first to want to help these seeking employment, Mr. Garlinghouse called on A. E. Paxton, publisher, Engineering News Record, to explain the mutually beneficial aspects which Title 2 of the GI bill of rights offers to both the veteran and the employer.

Warning the distributors against underestimating the veteran's ability, Mr. Paxton expressed his belief that Title 2 is completely workable and that it operates with a minimum of red tape. In order to operate under title 2 the employer must apply through his state labor agency where details of the plan are available. While the apprentice program is quite complicated, the on-the-job-program involves a little more than the employer making application and then advising the veterans that he has an on-the-job program in effect. Veteran working for such an employer receives as much as $65 a month from the government, if single, $90 if married, in addition to the normal job pay. The on-the-job training the veteran receives in the program is designed to speed up the time when he is capable of earning his maximum salary.

While all veterans are eligible, the initiative for putting the program in operation rests with the individual employer.

Robert H. Carter, Virginia Tractor Co., Richmond, Va., outlined the results his company had attained with the on-the-job program. He has found the program very beneficial, resulting in securing employes of higher than average intelligence and interest. Mr. Carter pointed out that the program was not limited to former employes.

(*Continued on page* 123)

H. O. Penn—Good Friend Passes

The industry lost an outstanding leader and many of us a fine friend in the passing of Hamilton O. Penn. "Ham," as we all called him, who was president of H. O. Penn Machinery Company, Inc., 140th St. and East River, New York, died suddenly January 31, of a heart attack at the Edgewater Beach Hotel, Chicago, where he was attending the convention of the Associated Equipment Distributors. Mr. Penn was the retiring

president of AED and had been extremely active through all but the last two sessions of the convention and the evening previous had attended the installation ceremonies for the Past President's Group.

Mr. Penn was born in Hartland, Wisconsin, September 9, 1896; attended Milwaukee State Normal College. He spent several earlier years in the construction industry as a construction superintendent. He then went into the manufacturing business associating himself with the T. L. Smith Company of Milwaukee, where he became assistant general sales manager. Early in the 1920's he decided to open his own business in construction equipment and located in New York City, which has since been headquarters for his rapidly expanding company.

Mr. Penn was a director of the Bronx County Trust Company, New York, and the Tyson Bearing Corp., of Massillon, Ohio, and a Trustee of several boys' clubs. He was a 32nd Degree Mason and a Shriner, member of the Moles and the Bronx Chapter of the Rotary Club. Active in all civil affairs, war drives, etc., he had just been named chairman of the Bronx Red Cross Drive less than one month ago, after having served two years as chairman of the Commerce and Industry Committee. He was also president of the Carmel Country Club and a member of the New York Athletic Club.

During the early stages of the war Mr. Penn was called to Washington as chief of the Used Construction Machinery and Track Type Tractor Sections of the War Production Board and served in that capacity for over one year when setting up the inventory and control for used construction equipment.

He is survived by his wife, Florence C. Penn, and daughter, Peggy Ann.

★ Showing layout of stockpiles; 3½-in. max. stone in foreground, and minus—¾-in. stone in pile to left

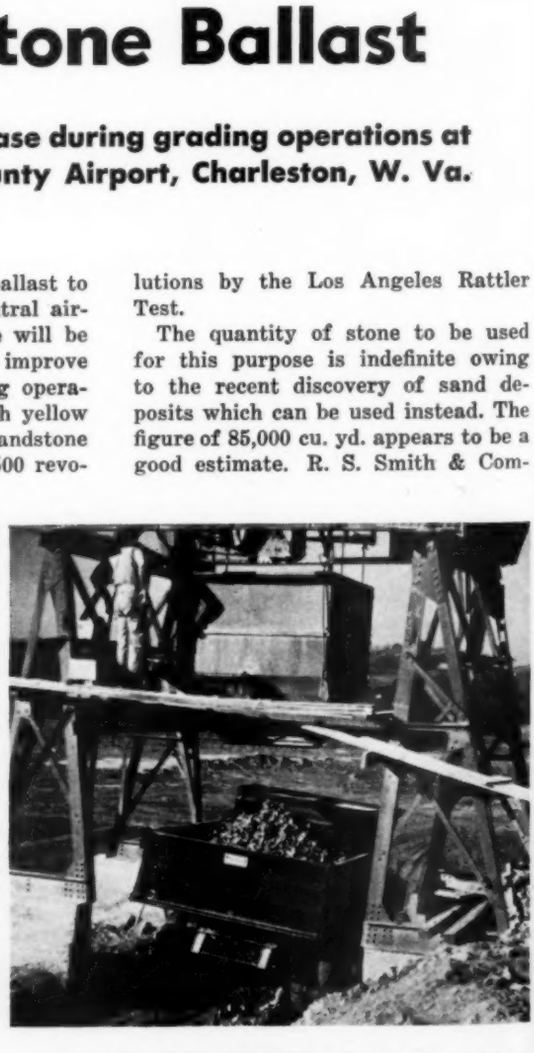
Stockpiling

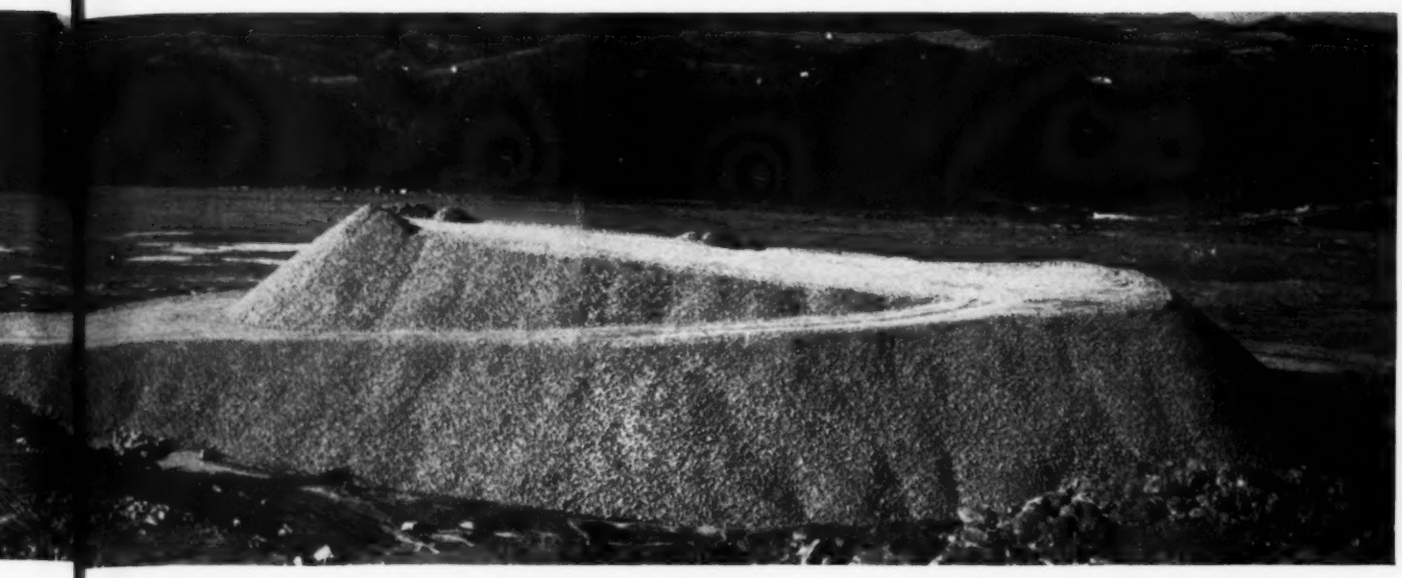
85,000 Tons of Stone Ballast

For runway base during grading operations at Kanawha County Airport, Charleston, W. Va.

THE nation's most spectacular airport grading job, at Charleston, W. Va., is involving an unusual stockpiling operation. Harrison Construction Company moved 4,100,000 cu. yd. of the 9,400,000 total in 14 months to Jan. 1, the yardage running nearly one-half rock. A portion of the rock is being crushed to provide ballast to top out the grade in the central airport area. The ballast stone will be placed in three layers so as to improve the subgrade prior to paving operations. The stone is a greenish yellow medium grain micaceous sandstone showing a 30% abrasion at 500 revolutions by the Los Angeles Rattler Test.

The quantity of stone to be used for this purpose is indefinite owing to the recent discovery of sand deposits which can be used instead. The figure of 85,000 cu. yd. appears to be a good estimate. R. S. Smith & Com-





pany, working in conjunction with Harrison Construction Company's grading contract, expects to stockpile this amount in the first phase of production. For this work a crushing and screening plant was set up on one corner of the project, on ground which had already been brought approximately to grade.

Two stockpiles were created, one pile for ¾ in. max. stone for use as base and one pile for sub-base stone graded up to 3½ in. max.

The crushing plant, assembled last summer, consists of units of several "makes," plus some shop-built equipment. Trucks dump from a natural ledge into a feeding hopper which represents considerable ingenuity in that the "belt" which feeds stone into the 21 x 36 in. primary crusher consists of the tracks off a crawler tractor. The tracks operate over special sprockets and power is furnished by a belt from one of the two power plants.

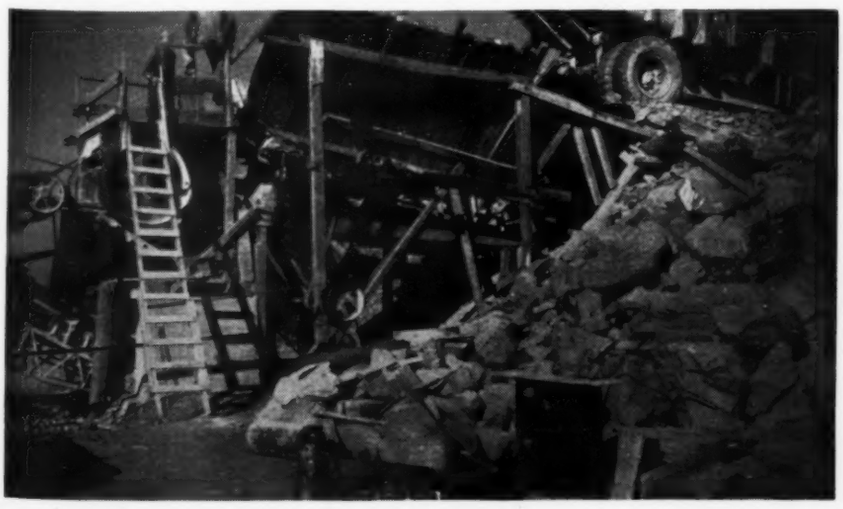
Dirt and excess fines are partially removed by a grizzly, then primary crushed material passes by belt to a vibrating screen, thence into the stone batching bin. Oversize is chuted back to an 11 x 36 roll crusher, thence back into the line by return belt.

A 120-hp. gasoline power plant powers the shaker screen and the roll crusher, a separate 120-hp. power plant operating the primary crusher and the main conveyor belt. This crusher outfit produced 54,000 tons from Aug. 1, to mid November, being rated at 120 tons per hr. max.

Considerable thought was given to the location and planning of stock piles. The central site for the piles was first carefully leveled to minimize reloading difficulties. One pile is located on either side of the plant. Truck drivers have been required to use care in dumping, so as to maintain a level floor as the lifts progress. Five-ton dump trucks have been employed for stockpiling, via a ramp road which circles the pile at approximately a 7% grade.

The foregoing data were obtained through the courtesy of Fred C. Alley, Director, Airport Section of Kanawha County Court, Charleston, W. Va.

★ Additional glimpses of the crushing plant assembled for the stockpiling job. Note location of secondary crusher on concrete pedestal; modern weighing equipment, "home-made" receiving hopper under which (not visible) a pair of tractor tracks is used as a feeder device



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T. R. Kendall Is Dead

Theodore Reed Kendall, Editor Contractors and Engineers Monthly since 1920, died Feb. 4 in Doctors Hospital, New York City, after an illness of 10 days. He was 55 years old. He was graduated from Harvard University in 1912 with a B.S. degree and in 1914 received Master of Civil Engineering degree from the Harvard Engineering School. From 1916-17 he was a water chemist at the Panama Canal. In the latter year he became engineering editor of the American City magazine, a position he held until 1938, except for a period in 1918 when he served as first lieutenant with the water supply section of the Army Sanitary Corps.

Mr. Kendall was a member of the American Society of Civil Engineers, the American Society of Mechanical Engineers, the Boston Society of Civil Engineers, the American Public Works Association, the American Public Health Association and the American and New England Water Works Associations.

He served on the board of directors of the American Road Builders Association and formerly was president and secretary of the Harvard Engineering Society.

★ 3-bottom turnplow, part of the equipment for dry and moist mixing; disc harrowing to further break up the soil; cement sacks were spotted accurately on the grade for hand dumping; soil-cement mixture being skimmed before rolling

Soil-Cement Streets for Subdivisions

By D. A. Loftus
Permanesque Homes Village, Inc.
Beverly Hills,
Alexandria, Virginia

DURING the past decade, the influx of government workers to the Washington, D. C., area brought a substantial demand for new housing. In 1938, our organization built a group of eight apartment buildings in Alexandria, Virginia, the development being known as Beverly Plaza Apartments.

For some time after the apartments were completed, Bruce Street—the single street on which the buildings were located—was an unimproved dirt street. It became so rutty and rough as a result of constant traffic that we realized something would have to be done about replacing it with durable construction to avoid excessive maintenance.

After considerable additional inquiry, we decided to use soil-cement on Bruce Street as a solution to the maintenance problem. That was in November, 1939. The job involved 3,310 sq. yd. of pavement, and we were fortunate in obtaining the assistance of the Alexandria city engineering department on the project. We furnished the money while the city put down the soil-cement with city equipment and labor.

The work proved so satisfactory that there was no question whatsoever about using the same method the following year (1940) for reconstruction of 32,700 sq. yd. of streets in nearby Beverly Hills where we had a 600-home development, and 13,195 sq. yd. in Beverly Park Gardens, still another project. In 1940-41, therefore, we placed 32,693 sq. yd, of soil-cement, improving six streets in this beautiful development.

It was the performance of the Bruce Street paving job during the severe winter of 1939-40 that convinced us of the value of soil-cement on secondary residential streets where low cost paving has been a problem. This paving came through that winter—perhaps the most severe winter in a decade—without a single surface break.

Used Standard Mixed-in-Place Methods

All our soil-cement work was built by the standard mixed-in-place method. The general soil types encountered on the streets processed were: (1) gravelly clay loams, (2) gravelly sandy loams, (3) sandy loams, and (4) clay loams. With these roadway soils was mixed cement in proportions varying from 10 to 12% by volume (.45 to .55 bag per sq. yd. of pavement), using 12% with soils having a heavier clay content.

On all the jobs, the cement and soil were compacted at optimum moisture content as determined by field laboratory tests. A uniform compacted depth of 6 inches was attained in the finished base.

In processing, heavy duty mixed-in-place equipment was utilized. For both dry and moist mixing, the city crews, assisted in the work by soils engineers of the Portland Cement Association, employed an offset disc harrow, a springtooth cultivator and a three-bottom turn plow. Then, in the compacting operation, a double drum sheepsfoot roller and 6 to 8-ton tandem smooth-wheeled roller (6-ton weight empty; 8-ton filled with water) were used.

Other pieces of equipment required on the projects were a spike-tooth harrow for spreading cement, a 1,500 gal. pressure water distributor, three track-type tractors (40 h.p.) trucks for hauling cement and one motor grader equipped with blade for shaping the soil-cement and with scarifier teeth for preliminary loosening of the subgrade.

After stabilization, all streets received a bituminous plant mix top, or wearing surface, placed on a prime coat. The tops were placed at varying intervals of time, the range being from one to three months after stabilization.

Service Checked

Naturally, we have been much interested in checking the performance records of soil-cement from time to time. As of the present writing, the cumulative evidence gathered from our observations points to excellent service records for all streets processed. Records show that less than one penny of the original cost has been spent for base maintenance, while upkeep on the wearing surface has been negligible.

Aside from the singular advantage of freedom from maintenance, soil-cement offers another distinct advantage which became apparent while construction was under way. This advantage, particularly helpful in subdivision development, was the fact that it was unnecessary to close the streets to traffic until both base and top were completed, as is often the case in street construction. Where processing began in the forenoon and ended later in the day, streets were ready for traffic the same day after final compacting with rollers. Actually, regular traffic using the streets following the final rolling had the effect of improving the compacted surface.

Furthermore, as already pointed out, regular traffic continued using these streets for a month to three months prior to the placing of the top.

We are convinced, too, that efficiency and convenience would be served in subdivision development by placing all utility lines off the streets, either alongside the street itself or in the rear of apartments or houses. Obviously, this would permit the construction of streets prior to building operations and make it unnecessary to tear them up for utility lines after completion of the structures. Such procedure is definitely on our postwar building program.

Consultants for Federal-Aid Secondary Roads Meet

The initial meeting of a Board of Consultants for Federal-aid Secondary Highways was held in Washington on Jan. 11 and 12. The board, composed of eleven representative county highway officials, met with Commissioner Thomas H. MacDonald and members of the Public Roads Administration staff to consider, in an advisory capacity, the steps that should be taken to promote the development of an adequate secondary-road system in each state.

Discussion at the meetings centered on development of the secondary road program for which funds were authorized by the Federal-aid Highway Act of 1944 and the framework for cooperation between the three agencies concerned—the counties, the state highway departments and the Public Roads Administration.

The Board of Consultants adopted recommendations which subsequently were approved by the Commissioner of Public Roads as steps which should be taken to promote the development of an adequate system of secondary roads. These recommendations are:

1. It is unanimously agreed that the most important benefits to be realized from the Federal-aid secondary program are not only the limited mileage of improved secondary routes that will result from the expenditure of the Federal funds immediately available, but also the promotion of better planning, administration and engineering in all local road work which will result if close and continuing cooperation is achieved between the three agencies concerned — the Public Roads Administration, the state highway departments and the local authorities. Steps which will aid in achieving this cooperation are:

a. The establishment in each State highway department of a Division of Secondary Highways. The primary function of such a Division would be to cooperate with the local authorities in administration, planning, engineering, construction and maintenance.

b. Encouraging development of competent local highway engineering. An effective method recommended is the assignment by State highway departments of direct responsibility to counties or groups of counties for as much of the work as feasible.

2. Counties should be encouraged to establish engineering organizations either individually or in combination of two or more counties.

3. The consultants feel that the Federal legislation, rules and regulations and procedures are thorough and comprehensive and provide a framework within which the states and local authorities can operate effectively.

Mail Inserted Card for Equipment Data

Again this issue of *Roads and Streets* carries descriptions of many new labor-saving efficiency devices and latest material developments. See our Postwar Parade beginning on page 113, for which a numbered reply card has been inserted to help you request data on items that interest you.

Traffic Survey for Ft. Wayne

A traffic survey is contemplated for Fort Wayne, Indiana, the purpose of which is to aid in determining the following steps in advancing safety and eliminating congestion: designation of certain arterials and alleys as one-way; installation of a modern traffic signal system; elimination of right or left turns, or both, during peak periods; elimination of parking on one or both sides of certain streets, according to traffic flow; control of pedestrian traffic; elimination of double parking for truck deliveries through establishment of ample loading zones.

Los Angeles Freeway Contracts Let

Believed to be first metropolitan city to let major contracts since the war in an urban expressway program. Section of Santa Ana Parkway and several over-crossings let

FAR flung Los Angeles, city of the angels and also home to the harassed owners of more than a million autos and trucks, is really going to have a new system of flesh-and-blood freeways—and soon. Contract was let in January for the first 1.6-mile section of the Santa Ana Freeway, to be a link in the main east-west expressway in an eventual 70-mile 2-axis urban system [see "Roads and Streets," January, 1945]. Peter Kiewit Sons' Co. was low bidder on the project with a price of $1,333,066.30, the items of which are being scanned with interest by the planners of similar "supers" in other large cities.

At the same lettings bids were received for four concrete overcrossings on the Santa Ana and Hollywood parkways, the low bids ranging from $128,000 to $141,000 for the respective street structures. Three of these projects have also been let, the fourth having been postponed because condemnation of homes for right-of-way clearance is not considered in the public interest during the current housing crisis.

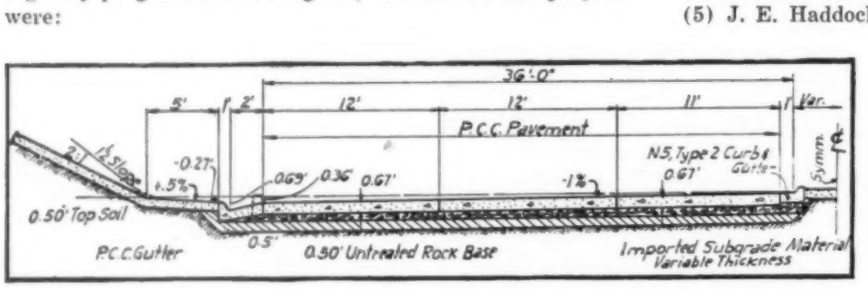
The Santa Ana Parkway will provide a freeway having two 36-ft. roadways with 12-ft. dividing strip. It will pass over or under various cross arterials. As shown in the sketches, the accompanying bid table represents figures for 8-in. uniform p.c. concrete pavement on 6 in. of untreated rock base and variable imported borrow subbase.

The plans for the Peter Kiewit contract provide for installation of water supply lines and sprinkling systems, for future landscaping maintenance. The native soil in this location is not suitable for carrying out extensive landscaping work, as is contemplated for this freeway, and it is proposed to have the contractor haul in 22,000 cu. yd. of topsoil, with a 3-mile haul. Prior to placing of the topsoil, the roadway slopes and other areas will be thoroughly cultivated parallel to the roadway or along contours until the soil is in a loose condition to a depth of at least 6 inches. The hauled-in topsoil will then be spread at uniform depth of 6 inches, and where necessary, stabilized by the use of straw and wire mesh and planted with seed. This latter work of stabilization if required will be handled and paid for as an extra work item. A subsequent contract will provide for the bringing in of fertilizer and the planting of shrubs, trees, and ground cover.

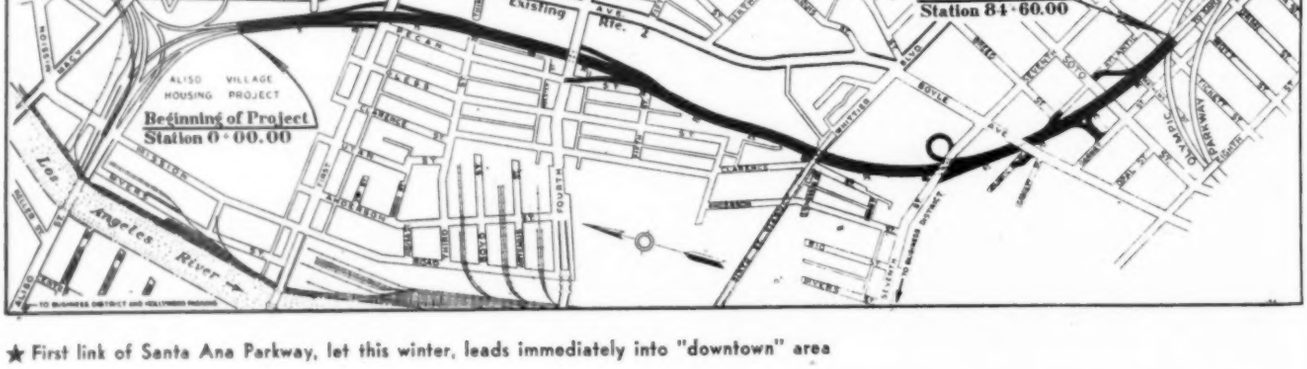
Bids on 1.6-Mile Section of Santa Ana Parkway, Los Angeles →

As received by the California Division of Highways, Dec. 6, 1945; grading, drainage and paving with concrete. This is the first section of a divided-lane, limited access highway program in Los Angeles. Bidders on this project were:

(1) Peter Kiewit Sons' Co., Los Angeles	$1,333,066.30
(2) Griffith Co., Los Angeles	1,372,281.40
(3) Guy F. Atkinson Co., Long Beach	1,383,605.00
(4) E. W. Elliott Const. Co., Lynwood	1,457,313.00
(5) J. E. Haddock, Ltd., Pasadena	1,586,421.60



★ Cross-section of the divided, limited-access roadway, Santa Ana Parkway



★ First link of Santa Ana Parkway, let this winter, leads immediately into "downtown" area

Items	Quantities	(1)	(2)	(3)	(4)	(5)
Removing concrete	4,000 C.Y.	3.70	5—	7—	7—	5.60
Clearing and grubbing	50 Ac.	135—	270—	75—	100—	420—
Roadway excavation	515,000 C.Y.	.37	.43	.55	.57	.63
Structure excavation	55,500 C.Y.	2.30	1.70	1.50	3.50	3—
Overhaul	6,500,000 Sta. Yd.	.003	.005	.004	.004	.006
Compacting original ground	10,000 Sq. Yd.	.03	.06	.05	.06	.09
Imported subgrade material	22,000 C.Y.	1.60	1.25	1.25	1.10	1.65
Untreated rock base	26,000 Tons	1.90	1.90	2.25	1.50	2—
Imported top soil	22,000 C.Y.	2.40	2.20	1.50	2.20	1.75
Preparatory landscape treatment	100,000 Sq. Yd.	.04	.07	.02	.20	.04
Dvlpg. wtr. sply. and furng. wtg. eqpt.	.....	2,000—	3,000—	4,000—	3,000—	30,000—
Applying water	8,500 M. Gal.	1.85	1.90	1—	1.15	2—
Finishing roadway	85 Sta.	10—	16—	20—	22—	50—
Lig. asph., SC-2 (pr. ct., P.M.S.)	2 Tons	25—	50—	40—	40—	27.50
Plant-mixed surfacing	400 Tons	15.25	5.20	4—	4.75	4.50
Asphalt concrete	3,150 Tons	4—	4.10	4—	5.50	4—
Asphaltic emulsion (paint binder and cur. seal)	24 Tons	47—	52—	40—	38—	30—
Cl. "B" P.C.C. (pavement and base)	17,500 C.Y.	11.80	13.60	12.50	9—	12.50
Pavement tie bolt assemblies	12,000 Ea.	.50	.70	.60	.60	.70
Cl. "A" P.C.C. (structures)	6,300 C.Y.	29.25	34—	40—	34—	40—
Bar reinforcing steel	630,000 Lb.	.07	.07	.06	.06	.069
Membrane waterproofing (pedest. underpass)	170 Sq. Yd.	1.25	2—	1.50	2.50	2—
Spatter dash finish (pedest. underpass)	300 Sq. Yd.	1.25	2—	1—	2—	1.25
Metal safety treads (pedest. underpass)	730 Lb.	.50	.50	.40	.50	.40
Pipe rail (pedestrian underpass)	109 Lin. Ft.	3.40	4—	3—	3.50	2.50
Handrailing (pedestrian underpass)	109 Lin. Ft.	3.40	4—	3—	4—	3—
Tunnel washing equipment (pedest. underpass)	.....	400—	500—	300—	1,200—	400—
Lighting equipment (pedest. underpass)	.....	2,500—	3,000—	2,500—	1,800—	2,300—
Rubber waterstops (retaining walls)	1,050 Lin. Ft.	2—	1.80	2—	2.50	1.30
Cl. "A" P.C.C. (curbs, gutters and sidewalks)	2,200 C.Y.	30.35	24—	30—	34—	28—
Cl. "C" P.C.C. (pipe reinforcement)	2,000 C.Y.	11.30	15—	12—	38—	16—
Cl. "A" P.C.C. (surface drain lining)	390 C.Y.	28.85	30—	30—	40—	36—
Metal plate guard railing	120 Lin. Ft.	2.50	2.70	2.50	2.50	2.75
Chain link fence	18,000 Lin. Ft.	1.70	1.80	1.50	2.20	1.60
Walk gates (chain link fence)	20 Ea.	50—	50—	50—	20—	57—
18" reinforced concrete pipe (std. str.)	1,880 Lin. Ft.	6—	3.50	3—	3—	3.80
21" R.C.P. (std. str.)	600 Lin. Ft.	6.50	4—	3.75	3.45	4.30
24" R.C.P. (std. str.)	30 Lin. Ft.	7—	4.50	4—	3.80	5—
24" R.C.P. (1,500-D)	120 Lin. Ft.	7—	4.50	4.25	3.80	4.90
24" R.C.P. (1,750-D)	70 Lin. Ft.	7.10	4.50	4.50	4—	5.20
24" R.C.P. (2,250-D)	80 Lin. Ft.	7.85	5.30	5—	4.70	6.20
24" R.C.P. (2,500-D)	110 Lin. Ft.	8—	5.30	5—	4.90	6—
27" R.C.P. (1,750-D)	110 Lin. Ft.	7.80	5.30	5—	4.65	6—
27" R.C.P. (2,000-D)	50 Lin. Ft.	8.75	6.30	6—	5.50	7.25
30" R.C.P. (1,500-D)	200 Lin. Ft.	8.50	6—	5.50	5.60	6.45
33" R.C.P. (1,400-D)	580 Lin. Ft.	10.25	7—	6.75	7—	7.80
33" R.C.P. (1,750-D)	280 Lin. Ft.	10—	7—	6.75	7—	7.85
33" R.C.P. (2,250-D)	400 Lin. Ft.	12—	8—	7.60	7.60	8.60
33" R.C.P. (2,500-D)	180 Lin. Ft.	11.70	8—	7.60	7.60	9.00
36" R.C.P. (1,500-D)	30 Lin. Ft.	11—	8—	7.70	7.25	9.65
36" R.C.P. (2,250-D, jack installed)	190 Lin. Ft.	70—	45—	12.80	27.50	26.50
66" R.C.P. (2,000-D)	570 Lin. Ft.	22.70	20—	19.50	19.50	22.40
72" R.C.P. (std. str.)	110 Lin. Ft.	23.50	19—	19—	20.20	20.75
6" V.C.P. (std. str.)	300 Lin. Ft.	3.60	.80	.60	1—	1—
8" V.C.P. (std. str.)	1,740 Lin. Ft.	4.15	1.30	.70	1.15	1.10
8" V.C.P. (ext. str.)	600 Lin. Ft.	4.60	1.70	.80	1.35	1.25
10" V.C.P. (std. str.)	200 Lin. Ft.	4.25	2—	1—	2.90	1.60
18" V.C.P. (ext. str.)	70 Lin. Ft.	5.60	3.70	2.50	3.25	3.35
21" V.C.P. (ext. str.)	850 Lin. Ft.	6.40	4.40	3.50	3.70	4.35
"B" manholes (sanitary sewer)	170 Lin. Ft.	45—	23—	15—	17.50	28—
"S" manholes (sanitary sewer)	80 Lin. Ft.	53—	22—	15—	19—	23—
"H" junction structure (sanitary sewer)	50 Lin. Ft.	45—	27—	15—	11—	35—
"F" junction structure (sanitary sewer)	70 Lin. Ft.	45—	23—	15—	11—	24—
Special shallow structure (sanitary sewer)	.....	170—	200—	100—	150—	200—
House connection caps (sanitary sewer)	90 Ea.	20—	27—	30—	5—	15—
8" plain concrete pipe (retaining wall)	36 Lin. Ft.	1.10	1.40	1—	1—	1.85
12" plain concrete pipe (storm drain)	200 Lin. Ft.	4—	1.90	1—	1.25	1.55
15" plain concrete pipe (storm drain)	6,000 Lin. Ft.	4.50	1.60	1.40	1.70	1.80
4" cast iron pipe	150 Lin. Ft.	4—	2.30	1—	1.25	2—
8" cast iron pipe	270 Lin. Ft.	9—	4.30	2.50	2—	3—
Pipe shaft manhole (storm drain)	36 Lin. Ft.	24—	10—	20—	15—	13—
Remodeling manholes	3 Ea.	200—	50—	65—	50—	150—
Adjusting manholes to grade	2 Ea.	185—	100—	35—	50—	30—
Miscellaneous iron and steel	55,000 Lb.	.25	.21	.25	.20	.21
Turning unions (sprinkling system)	120 Ea.	45—	24—	20—	15—	52—
Sprinkler connections (sprinkling system)	250 Ea.	21.60	12.50	12—	5—	25—
¾" galvanized pipe (sprinkling system)	11,300 Lin. Ft.	.70	.80	.70	.25	.40
1 " galvanized pipe (sprinkling system)	15,100 Lin. Ft.	.75	.90	.80	.40	.60
1¼" galvanized pipe (sprinkling system)	3,200 Lin. Ft.	.85	2—	1.75	.50	.90
1½" galvanized pipe (sprinkling system)	3,100 Lin. Ft.	1—	2.20	2—	.65	.95
2 " galvanized pipe (sprinkling system)	4,700 Lin. Ft.	1.10	2.60	2.50	.90	1—
2½" galvanized pipe (sprinkling system)	3,600 Lin. Ft.	1.35	3—	2.75	1.10	1.25
3 " galvanized pipe (sprinkling system)	2,300 Lin. Ft.	1.70	3.50	3—	1.40	1.65
4 " galvanized pipe (sprinkling system)	1,330 Lin. Ft.	2.20	4—	3.50	1.75	2.10
Traffic warning system	.....	11,360—	13,000—	10,279—	7,500—	11,000—

Girding for the

Big Postwar Task

How highway engineering must be reorganized and obsolete highway departments revamped, is outlined in this article, covering thoughts given at recent AASHO annual meeting at Oklahoma City

By Thomas H. MacDonald

Commissioner
Public Roads Administration

JUST a little more than one year has passed since the Congress enacted the Federal Highway Act of 1944. About four months have gone since the funds provided became active. It is an appropriate time to report the administrative planning to prepare for effective operation under the guidance and authority of this fine concept of coordinated local-State-Federal effort.

This legislation is designed with a national pattern of ways and means to achieve highway improvement through joint administration between the Federal Government and the States, and with Federal recognition of the sovereignty of each state, to extend, through the state, Federal assistance also to county and municipal units. It provides legal authority for Federal action within the broad objectives which are defined, and very substantial Federal funds for use in bringing these predetermined objectives to realities.

Basic Problems Unchanged

While the war years have profoundly affected personal life, in an overall sense the problems in the highway field retain with little change their prior form and dimensions. Perhaps chief among these were the almost universal failures to cope with urban congestion, and the need to supply an extensive mileage of improved secondary roads. The five war years have intensified the lags in both major and minor roads, and have accented the familiar pattern inadequacies.

The foregoing examples serve to highlight the sound tenets that have emerged since the basic Federal legislation of 1921, and which now guide the formulation of administrative policies under this new greatly broadened legal base. Under this legislation it is possible for the first time, on reasonably adequate scale, to reach these segments of the general highway plan so vital to a comprehensive local highway service, and concurrently to modernize and re-develop the highways of the Federal aid system to meet the growing national traffic demands.

No small or short-time program will advance us very far. The work ahead . . . seems relatively greater than it did a quarter century ago. It is, however, only the physical task that assumes these magnified dimensions. In the intervening years the building of competent highway organizations and the development of technical knowledge, make possible now work of a character that could not have been considered when modern highway improvement was first started. The spectacular advance in the power, performance and versatility of road building equipment has set a world record. The recognition of the essential qualities of the modern equipment as perfected in the United States, is attested by the growing procession of foreign engineers and officials now coming here to study problems of engineering and construction akin to their own.

The final, and by no means least essential element in our highway improvement industry is the contractor's organization. It is not possible to emphasize too strongly the contribution to the velocity of our highway progress as a whole that must be credited to the highway contractors and their competent, highly skilled personnel.

The Congress has reposed great confidence in the State highway departments and in the Public Roads organization. Equally it has set in motion a program that requires a *severe break with past policies, organization and procedures,* and major adjustments to administer with despatch and efficiency the new extended program. The two most important departures are, (1) a program that consists of three relatively larger operations for improvement of the Federal aid, rural secondary and main urban roads, (2) a greatly increased number of projects, and (3) many more officials who have an interest and a legal relation to these projects. Interpolated here is the observation that if we as State and Federal officials, are intelligent enough and competent in essential understanding, no comparable break in the long traditions of highway administration will come in any foreseeable future. It will be the perfecting of the pattern of administration now entrusted to us by the Congress.

PRA Organization

The Public Roads Administration has put into effect a comprehensive reorganization. This is predicated upon our responsibility to develop close relations and working agreements with the States, and through the States with the county and municipal highway organizations. These closer relations have two primary purposes; to develop administrative procedures, simple and technically sound; and to plan the routines for handling projects in largely increased volume to provide fiscal and technical control without unnecessary loss of time.

Our conception of how to accomplish these desired ends is indicated by the following actions which are now in effect. This is with the qualification that some of these policies entail continuing refinement and the acceptance of the new operating procedures on the part of our field organization.

1. *To meet the greatly expanded Federal program, there is effected a major reorganization of Public Roads, in pattern, in physical distribution, in delegated authority to the officials with which the State highway departments deal directly.* Nine domestic divisions have been established. The Public Roads representative becomes a Division Engineer whose duties are supervisory rather than operating. Each State within the Division becomes a district with a district engineer in charge, whose principal duties are to carry on, in cooperation with the States, the actual operations.

2. *A cooperative agreement has been made with the American Association of State Highway Officials, to provide for development of administrative and engineering regulations through joint committee action.* Every PRA memorandum or regulation under the new legislation has had the scrutiny of an appropriate AASHO committee. We believe this procedure sets a new pattern for administering joint State-Federal undertakings.

Secondary Road Board

3. *To reach into the rural field there has been appointed a Board of Consultants on Secondary Roads.* The Board is representative of the most advanced county engineering organizations, and we believe the advice and counsel of this group will be effective in the determination of the policies which will be most productive in the secondary road program.

4. *For the immediate future there is to be formed a Board of Municipal Engineers,* acting as consultants to represent the urban group.

This plan places in operation a forum before which complaints at any level can be stated and impartially considered. This method of approach to administrative problems lifts the discussion above the level of personal opinion and brings to bear the judgment and experience of an informed group representing both the State and Federal highway officials. Emphasis is placed on balancing the relations between the State and the Federal Government. Each has its own responsibilities, and it is apparent that such a plan of procedure makes possible the consideration of important matters covering the whole range of technical, administrative and fiscal questions generated by a program as extensive as that now to be placed under way.

Research Board and Highway Officials Hold Outstanding Meetings

The Oklahoma City convention sessions of the Highway Research Board and American Association of State Highway Officials brought out a volume of discussion and technical papers on literally scores of problems. The March issue of "Roads and Streets" will report rather fully on these meetings.

New AASHO Leaders

M. J. Hoffman, Minnesota commissioner of highways, was elected president of AASHO, succeeding Herman A. MacDonald, Massachusetts.

C. W. Philips, Tennessee commissioner of highways and public works, became first vice president. Regional vice presidents: Harry B. Henderlite, chief engineer, Louisiana; Spencer Miller, Jr., commissioner, N. J.; W. W. Polk, chief highway engineer, Ill.; R. H. Leavitt, chairman of commission, Utah.

G. H. Henderson, Rhode Island highway director, was reelected treasurer, and Hal H. Hale, Washington, D. C., continued as executive secretary.

In addition, H. E. Sargent, Vt., and C. W. Brown, Mo., were re-elected to the Executive Committee for five years.

F.A. Secondary Progress

As of January 17, 1946, the status of Federal-aid secondary systems was as follows:

Status	Number of States	Mileage
Awaiting review	3	17,991
Under review	5	32,306
Reviewed — awaiting further information	3	6,146
Approved	31	95,319
Total submitted	42	151,762

In many States the approved mileage covers a small initial submission sufficient only to provide a selection of the first year's program of projects. In the 21 states that have made substantial submissions, the Federal-aid secondary systems average about 9.4% of the total rural road mileage in the state. The largest initial submissions to date are from Florida and Louisiana, with 18.2% and 14.0%, respectively; the smallest involves one route five miles long in Massachusetts.

In a few states the counties are offered only the minimum degree of participation required by the 1944 Act, i.e., a voice in the selection of the routes to be designated in the Federal-aid secondary system, without subsequent county participation in the formulation of the program or in the actual construction. In other states there has been established in the state highway department a Division of Secondary Highways with an engineer in charge who has full authority to cooperate with local highway organizations and to delegate to them as much of the responsibility for planning, engineering and construction as each county is organized and equipped to undertake. This type of cooperation is patterned after that which has been successfully established between the State highway departments and Public Roads.

Cooperation of Far-Reaching Value

A high degree of cooperation between State highway departments and counties in the Federal-aid secondary program will have far-reaching benefits.

The Board of Consultants on Federal-aid Secondary Roads, as a result of their first two-day conference with Public Roads officials, have agreed unanimously on the broad precept that the most important benefit to be derived from the Federal-aid secondary program, since a relatively limited mileage of roads can be built with the Federal-aid funds available, is the promotion of better planning, administration and engineering in all local road work, which will result if close and continuing cooperation is achieved among the three agencies concerned—the Public Roads Administration, the State highway departments and the local authorities. Steps which will aid in achieving this cooperation are:

1. (a) The establishment in each State highway department of a Division of Secondary Highways, the primary function of which would be to cooperate with the local authorities in administration, planning, engineering, construction and maintenance.

(b) Encouraging the development of competent local highway engineering. An effective method recommended is the assignment by State highway departments of direct responsibility to counties or groups of counties for as much of the work as is feasible.

2. Counties should be encouraged to establish engineering organizations either individually or in combination of two or more counties.

We are in complete accord with

these recommendations made by the Board of Consultants.

The administration and management of highway affairs have failed to keep pace with the scientific and technical advancements that have been made in the field of construction and maintenance. The urgency of building as rapidly as possible an extensive system of highways has perhaps necessarily forced administration and management to a role of secondary importance.

Management Is Key

Now, with the greatly enlarged scope of operations, management becomes of paramount importance. This subject is particularly timely. With the end of the war the highway administrator faces a great test in the period of reconversion as well as in the more distant future. The Federal Aid Highway Act of 1944 imposes an administrative responsibility very much greater than at any previous period upon the Public Roads Administration and the State highway organization.

Successful administration will depend to a greater degree than ever before upon how well the State organizations are prepared to meet the situation. **In many cases the State administrative organization is poorly adapted to perform the greatly increased tasks of the immediate future. In the main these States still have the organization structure set up more than 25 years ago, except for additions through the natural process of accretion. The result is an obsolete type of organization, inadequate and ill-suited to proper and well managed operations.** In such cases the only possible solution is a major reorganization which will achieve the modern, efficient and integrated structure essential to present-day administration.

Almost the whole of management may be expressed in terms of personnel. To do the job at hand, highway administration must command professional and technical competence, and it must be organized to take full advantage of the best talent available. Finding the right people for the high-level positions is important and difficult.

During the war period highway departments lost heavily of their best qualified engineering personnel. Some are returning, but many others will not return because of greater inducements elsewhere, particularly in private industry. Thus we find ourselves with a paradoxical situation, in which the public service cannot compete with private business for administrative and professional personnel, while it is recognized that the public service demands the best talent for effective administration. An examination of the facts quickly proves why this situation exists.

Better Pay Imperative

Statistics of salary scales recently submitted by the highway departments show the range in salaries of the chief engineering officer is from $4,500 to $15,000. The median salary for all States is $6,350. Posts of comparable responsibility in private industry, or even in the Federal service, command much greater salaries. Moreover, the salaries paid have little or no relation to the responsibilities of the position or the work load, as measured by such approximate indices as mileage administered, construction and maintenance budgets, and the size of the organization.

A similar condition exists in other top administrative posts. For example, chief construction engineers' salaries range from $3,360 to $10,500, with a median salary of $5,000. Likewise for the position of bridge engineer, the range in salaries is from $3,600 to $9,000.

In the intermediate grade engineering positions such as resident or project engineers, the situation is equally unfavorable. The range in salaries is from $1,620 to $4,800. For the lowest grade of engineering personnel, the starting salary ranges from $900 to $2,100. While several states pay a liberal starting salary to their lowest grade of engineering personnel, the vast majority of the highway departments pay a wage less than the average Government clerk receives. Obviously salaries of this kind will not attract the better engineering talent. It is little wonder that highway organizations have found so much difficulty in attracting and holding competent personnel.

Responsibility Varies

The variation in the classification and compensation of positions is astounding. No general and consistent relationship in pay between similar employments is to be found among the States. A marked compression is noted, however, because of pressure upward by increases of lower-paid positions at the bottom, and from the general disinclination of public authorities to recognize the importance and responsibility of positions at the top by proportionate increases. There is a serious need for a general overhauling of the job classification systems and compensation scales to bring them near the levels for corresponding positions in private business and industry.

During the war period there has been some general upward revision of wage scales in some States, while others have given so-called cost-of-living bonuses. In some cases flat increases were given to all but department heads and top administrative posts. But in the main the increases were insufficient to compensate for the rise in the cost of living of 26% since January, 1941, as reported by the Bureau of Labor Statistics.

Despite the foregoing, the highway profession surprisingly has retained men of excellent calibre. However, most of the leaders in this field have reached the age of 50, and many are well past 60. The recruitment and training of engineers to replace these men and fill existing vacancies, is urgent. In addition, the expanded program will require many more competent engineers. Too little attention has been given in the past to systematic recruitment, training and replacement.

Other Inducements

Not only must the salary level be raised sufficiently to attract and hold competent engineering personnel, but efforts should be made to make state highway employment more attractive and secure. Surveys have indicated that greater assurance of continuity of employment, better opportunities for advancement and rewards for outstanding service, and freedom from politics are desirable and will offer additional inducements to engineering personnel. More liberal sick leave, vacations, extension of retirement systems and the security offered by the inauguration and extension of Civil Service should be explored as possibilities for adding to the attractiveness of State Highway employment.

We are very hopeful this Association will agree that a serious effort must be made to strengthen the highway department organizations and to

PRA has been reorganized.
Some states still must revamp obsolete departments.
Federal and secondary road procedure is making headway.
Spotlight is on management.
Big problem: how to attract A-1 personnel.

raise the standards of compensation so as to reasonably permit each department to compete with private organizations and other public departments in securing and retaining first-class engineers in all grades, accountants, and highly qualified specialists in traffic, landscape development and other fields essential to an adequate highway department. Probably a subcommittee of the Committee on Administration should be designated to carry on this study and to report back to the Association in time for the next sessions of the State legislatures. We may as well face the fact that many states will not be able to build adequate organizations to carry on the program now provided, unless they recognize that competent highway technicians are not available at present salary rates. A study of present salary scales and a recommended schedule can be developen without subjecting either departments or individuals to any personal embarrassment.

Such a study should include recommendations for joint action with the universities and colleges for the selection and training of young engineers to build the State highway organization constantly from the bottom. Everything possible should be done to make an attractive career job as secure as employment can be made if the service rendered is competent. This question of sufficient competent personnel for each highway department is a serious one, since we see the probability that Federal funds will be forfeited by some states because of lack of organization to prepare adequate, accurate contract plans.

A discussion of urban Federal-aid highway administrative problems and progress in selecting the Interstate System, included in Commissioner MacDonald's original paper, has been omitted for lack of space. Future issues of "Roads and Streets" will cover this topic.—EDITORS.

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Gas Tax Increase for County Roads—Bill before Kentucky State Legislature proposes a 1c per gallon gasoline tax increase, 1c tax on each quart of lubricating oil, $10 tax on each hand-operated gasoline pump and $50 tax on each electrically operated gasoline pump. Receipts would be used for construction and maintenance of county roads and bridges.

Why Construction Costs Will Continue to Rise

WORLD War No. 1 came to its end 27 years ago. There are many engineers now in high positions who then were newly graduated. An engineer who did not estimate construction costs a generation ago is not apt to remember that in 1919 they were double what they had been in 1914. Nor is he likely to remember that it was the almost universal belief that wages would soon return to the 1914 level; and that numerous bids were rejected because of that belief. Economic history is repeating itself in that respect. We shall see no decrease in present wages, but, instead, a progressive increase at a much faster rate than that between 1919 and 1929. During that decade average wages rose 20%. Even the depression decade that followed did not bring wages to a lower point than they were in 1919 when they were twice as high as in 1914.

Between 1914 and 1919 per capita money increased 60%, whereas between June 30, 1939 and June 30, 1945, it increased 174%. During the last six years, weekly wages in factories increased 109%, and there was a similar increase in wages of construction workers. In Roads and Streets, August, 1945, an article by Halbert P. Gillette on "Past and Future Wages" gave data showing that annual wages in American factories in 1939 averaged nearly 5 times what they were in 1849, and that per capita money in 1939 was 6.5 times what it was in 1849. Yet in 1939 there was very extensive unemployment, about 9,000,000 of the 56,000,000 workers of all kinds being out of jobs. Mr. Gillette's table of wage averages at 10-year intervals shows that in the year 1929 when there was no appreciable unemployment, annual factory wages averaged 5.2 times what they were in 1849, and that the per capita money ratio was 4.4.

There is no economic law better established statistically than this: In the long trend American average wages are proportional to per capita money that is outside the U. S. Treasury. Based on this law, Mr. Gillette estimates that average monthly wages in America will become four times what they were in 1929. In that year they averaged $108 in American factories. In March 1945, they averaged $200; and they are destined to become more than $400 within the next few years when full employment is again restored.

Were it not that few men are acquainted with such statistics as those just cited, it would be amazing that any engineer would recommend the rejection of a construction bid because it exceeds some arbitrary dead-line, e.g. 35% above prices in 1940. Those prices are ancient history, and will not be seen again until construction equipment shall have been invented that will make present machines look like toys.

Every nation engaged in the recent war has witnessed great inflation of its currency and a corresponding inflation in wages, except where the effort is being made to hold them down by governmental dictatorship. Our federal administration has given much publicity to its alleged success in having prevented wage and price inflations comparable to those of the last war. It talks about having held factory wages to an increase of only 50%, but avoided mention of the fact that the 50% increase related only to the hourly wage for a basic 40-hour week. With the actual 48-hour week and time and a half for the 8 hours in excess of 40, the weekly wage had become double what it was before the war! Between 1939 and 1945 the weekly wages of coal miners rose 125%; the wholesale prices of grains rose 153%; the price of cotton rose 135%. Not the slightest effort was made to reduce those and other prices of farm products, for the good reason that it would be politically fatal to the party that made such an effort.

•

$3,000,000 Asked for Alaska Roads

Congress was asked recently for $3,790,400 to begin road improvements in territorial Alaska, of which $2,300,000 is to be spent for new roads to open up agricultural regions.

A 3-year program involving 407 miles of new routes costing $9,540,000 is contemplated. Individual routes include anchorage to Porter (12 mi.), Kenai Lake to Homer (125 m.,), Tanacross to Eagle (115 mi.) Richardson Highway link to McKenley park road, 155 miles. Maintenance of 210 miles of the Alaska highway within the territory is included, at an estimated cost of $157,500 for 1947. A $250,000 survey fund was also requested.

Self-Propelled Spreader Box Simplifies

Macadam Widening

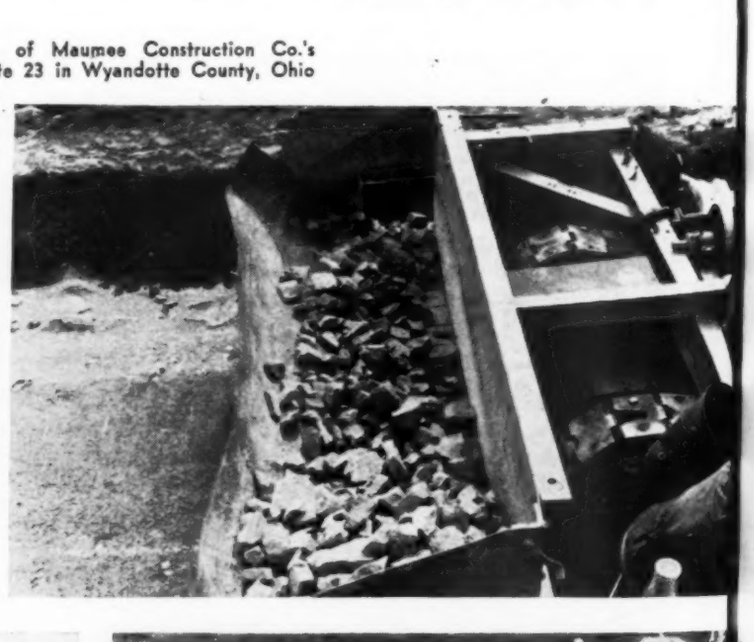
★ How to spread 50 tons of stone per hour with almost no labor

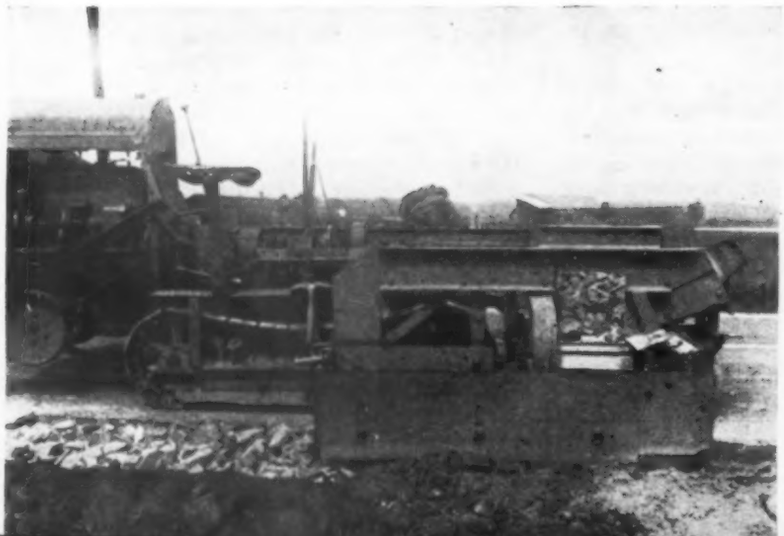
Maumee Asphalt Paving Co. built this highly efficient machine from power unit off of a ditcher

OHIO continues to be a hotbed of new labor saving, job speeding ideas for pavement widening equipment. [See "Novel Trenching Methods for Stabilized Soil Widening," "Roads and Streets," Sept., 1945, page 104.] This time the credit goes jointly to the Maumee Asphalt Paving Co., of Findlay, Ohio, and engineers in the Ohio department of highways. The machine in question is simple enough —and therein lies its success. It consists simply of a power unit and crawlers from a ditcher, to the front of which has been attached a stone dumping hopper with a transverse conveyor in the bottom, and a spreader box at the side for receiving and measuring stone into a pavement widening trench. That's all! And how it traveled on Maumee's 25 miles of 1945 projects. The machine was specially devised for dry bound macadam widening work, which consists of trenching, then placing a 5-in. course of dry bound macadam and a 3-in. leveling course of hot mix, followed by 1 in. of hot mix binder and a 1¼-in. surface over the full width of the road.

In operation the machine works much like any stone spreader. Once the truck has backed up to the hop-

★ These views give a clear idea of the mechanical details of Maumee Construction Co.'s shop-built stone widening spreader. Photos taken on Route 23 in Wyandotte County, Ohio





per and raised the hoist, the unit propels the truck. The lateral conveyor works from the same power source, via a separate clutch of course. It saves labor of one or two men, adds several hundred feet a day to runs compared with other methods, and leaves stone so evenly spread that no hand raking or redistribution of stone is necessary. About 50 tons of stone is put down per hour.

Trenching is done by various methods, and stone is compacted with a trench roller. A smooth roller also takes a run along the earth shoulder after it is thrown back against the widened pavement.

Photos courtesy Fred Swineford, chief, bureau of construction, Ohio department of highways.

Price Trends
In Highway Construction

As gathered and interpreted by the Public Roads Administration in a bulletin, "Construction Materials and Public Construction Summary" No. 29, Nov.-Dec., 1945, issue. This summary brings up to date an article on the subject published in April, 1945, "Roads and Streets"

THE amount of highway improvement that can be purchased by any given appropriation is determined by current prices. A knowledge of prices and price trends is, therefore, a prerequisite to proper planning and financing of both our present and future requirements.

To provide definite information as to price movements and price trends in highway construction the Public Roads Administration maintains a current record of the quarterly variations in contract unit bid prices. This price trend record extends back to 1922, which is about the earliest date at which rural highway construction had reached sufficient nationwide volume and had become sufficiently standardized to provide a fairly reliable basis for the comparison of unit construction costs and progressive price movements.

The present price trend indices are based on the average annual construction on State and Federal-aid highway systems during the five years 1925-1929, inclusive. The averages for these years are taken as 100%. For this period the total quantity and contract cost of each of the principal cost controlling contract items were summarized and divided by the total mileage of construction during this period. This operation provided a set of figures which might be termed the average quantities of each type of work involved per average gross or composite mile of construction. In this manner it was found that each mile of construction during this period involved the average movement of 17,491 cu. yd. of grading, the placing of 3,726 sq. yd. of paving, 16,000 lb. of reinforcing steel, 4,325 lb. of structural steel and 68 cu. yd. of structural concrete.

Since both unit prices and construction volumes vary not only from state to state but also from year to year, the percentage of each item contributed during this five-year period by each state was adopted as the contributing state base. The current price trend thus indicates the relative present costs at which the average quantities placed per mile in 1925-1929 and with the same state distribution could be replaced today at current contract bid prices.

One of the most interesting features illustrated by the price trend curves is the long period of falling unit prices, which with the exception of the sudden recovery from the abrupt depression drop in 1931 and 1932 extends to the outbreak of World War II. Much of this decline was no doubt due to the continuing development of more effective and efficient equipment and the adoption of improved methods of both operation and design. The question now facing the highway planner and administrator is how soon and to what extent, if any, will this declining trend in highway unit construction costs be resumed. All present indications are that the wartime peak, reached in 1943, has been definitely passed. The rate of future decline, however, is still problematical. However, within another year, perhaps sooner, the probable course of further price trends will undoubtedly be indicated more clearly.

Public Roads Administration
Price Trends in Highway Construction

	COMMON EXCAVATION		CONCRETE PAVEMENT		STRUCTURES BID PRICE				
YEAR	Bid Price Cu. Yd.	Sub-Index	Bid Price Sq. Yd.	Sub-Index	Reinforcing Steel-lb.	Structural Steel-lb.	Structural Concrete Cu. Yd.	Sub-Index	Composite Mile Index
1922.....	$0.40	114.5	$2.28	102.7	$0.050	$0.074	$20.18	95.1	105.8
1923.....	.47	133.3	2.43	109.5	.057	.078	23.37	108.6	117.9
1924.....	.43	122.2	2.40	108.3	.057	.077	22.91	107.2	113.1
1925.....	.39	110.0	2.36	106.4	.056	.067	22.53	103.9	107.5
1926.....	.36	103.7	2.29	103.1	.053	.074	22.76	103.7	103.4
1927.....	.35	100.3	2.29	103.3	.051	.071	22.65	101.5	101.9
1928.....	.34	96.0	2.10	94.5	.049	.067	21.22	96.1	95.3
1929.....	.32	90.0	2.05	92.7	.048	.059	21.58	95.0	92.1
1930.....	.30	86.3	1.86	84.1	.045	.061	20.08	89.4	85.7
1931.....	.27	77.6	1.68	75.6	.040	.054	18.02	70.9	76.8
1932.....	.18	55.0	1.44	64.8	.034	.046	15.33	68.0	61.0
1933.....	.26	74.0	1.67	75.1	.038	.046	16.15	72.2	76.7
1934.....	.29	83.3	1.90	85.8	.043	.053	17.73	80.8	84.0
1935.....	.26	73.3	1.90	85.6	.044	.052	17.78	81.5	80.6
1936.....	.26	74.8	1.91	86.0	.046	.060	20.25	90.0	82.9
1937.....	.24	69.0	1.89	85.1	.048	.066	19.76	91.5	79.4
1938.....	.21	59.8	1.72	77.5	.045	.063	19.06	87.2	72.8
1939.....	.21	59.8	1.73	77.8	.044	.059	19.13	85.9	72.6
1940.....	.21	59.2	1.68	75.6	.045	.063	19.17	87.6	71.6
1941.....	.24	69.2	1.89	85.2	.054	.076	21.44	100.8	81.8
1942.....	.37	105.5	2.44	109.7	.065	.090	26.16	122.3	109.9
1943.....	.44	125.6	2.78	125.7	.067	.095	30.19	134.4	126.9
1944									
1st Qr....	.39	111.1	2.67	120.4	.066	.094	30.35	134.4	119.1
2d Qr....	.38	108.3	2.48	111.8	.064	.093	32.62	138.9	114.7
3d Qr....	.39	111.0	2.48	111.8	.064	.091	34.24	142.7	116.3
4th Qr...	.36	102.9	2.51	113.1	.062	.078	30.53	130.0	112.1
Average.	.38	108.3	2.54	114.3	.064	.089	31.94	136.5	115.5
1945									
1st Qr....	.37	105.1	2.50	112.6	.062	.077	30.47	129.5	112.7
2d Qr....	.35	100.0	2.50	112.6	.061	.075	31.50	131.0	110.9
3d Qr....	.37	105.2	2.51	113.2	.062	.076	31.60	132.2	113.3
Base 1925-29 ..	.35	100.0	2.22	100.0	0.052	0.067	22.15	100.0	100.0

Note: During the years 1925-29 inclusive the average mile involved the movement of 17,491 cu. yd. of earth and similar materials, 3,726 sq. yd. of paving, 16,000 lb. reinforcing steel, 4,325 lb. structural steel, and 68 cu. yd. of structural concrete. These quantities form the base for the composite mile.

Highway Construction—1946

Reports from officials of state highway departments on their programs for this year

New England States

Maine

THE 1946 program calls for construction of 60 projects at an estimated cost of $6,150,000. By types these projects are as follows:

	Projects	Miles	Est. Cost
Low type bit.....	47	88	$3,920,000
High type bit.....	12	25	1,880,000
P. c. concrete.....	1	4	350,000

New Hampshire

Construction proposed for this year calls for expenditures of $3,414,000. It covers 12 projects as follows:

	Projects	Miles	Est. Cost
Low type bit.....	10	38	$2,271,000
High type bit.....	1	2	393,000
P. c. concrete (incl. bridge)	1	0.6	750.000

Vermont

The construction program includes 44 projects, estimated to cost $3,911,-600. By types these are:

	Projects	Miles	Est. Cost
Low type bit.*.....	14	14	$ 541,300
High type bit†.....	26	36	2,850,900
P. c. concrete.....	4	3	519,400

* Gravel, bituminous treated. † Mixed. in place.

Massachusetts

Thirty-one state highway projects, estimated to cost $9,810,000 are proposed for fiscal year ending June 30, 1946. These projects by type are:

	Projects	Miles	Est. Cost
Graded and drained	1	1.5	$ 900,000
High type bit.....	22.5	30.8	5,237,000
P. c. concrete	7.5	16.3	3,673,000

State-aid work is not included in the above as these projects depend on action at Town Meetings in spring of 1946. Nor does it include projects for which plans are complete but which are scheduled for fiscal year 1947, if appropriations are made by the Legislature.

Rhode Island

Six projects estimated to cost $2,-000,000 are proposed for 1946 construction. These include one 5-mile project for graded and drained highway to cost $450,000; one 2-mile high type bituminous project to cost $225,-000; and 4 P. c. concrete projects, 10 miles in all, to cost $1,325,000.

Connecticut

An $11,329,000 construction program covering 54 projects is proposed. By types the projects are:

	Projects	Miles	Est. Cost
Graded and drained	6	17.1	$2,687,000
Gravel or stone surfaced	2.4	4.4	138,000
Low type bit.....	1	0.4	142,000
High type bit.....	10	12.6	1,294,000
P. c. concrete.....	12	26.6	4,382,000
Bridges	23	..	2,686,000

In addition, since V-J Day the state highway department has received bids on 48 projects of various sizes to a gross value exceeding $4,000,000. Some of these projects were started before the close of the 1945 construction season and will be resumed in the spring of 1946. All of the others are slated for opening in the first good weather of spring. It is anticipated that there will be in the vicinity of $3,500,000 worth of work under the Connecticut town aid statutes.

Middle Atlantic States

New York

During 1946 the state, through its Department of Public Works, anticipates the award of at least $125,000,-000 in contracts for highway construction. Included will be sections of the New York State Thruway System, initial urban arterial connection projects and grade crossing elimination jobs as well as grading and construction work on many sections of the highway system generally. Three, and possibly four, sections of the Thruway are scheduled for construction during the year with work to begin in the spring. Arterial routes within municipalities will be developed in many sections of the state. The present program of the Department calls for the expenditure of $840,000,000 on public works construction within the next five years. This will include $368,000,000 for construction and reconstruction of standard type highways to restore the state's 14,000 mile highway system to a high level of efficiency adequate for modern traffic. The 486-mile Thruway is expected to cost $202,000,000 and $119,000,000 has been earmarked for arterial connections. Of the balance, $72,000,000 has been scheduled for parkways, $60,000,000 for grade crossing eliminations and $19,000,000 for canals and other miscellaneous projects.

New Jersey

The budget of the state highway department, recommended by the Governor for the consideration of the legislature, includes $8,391,957 of state monies to be matched by an equal amount of Federal funds for the current year's construction operations. A recommendation of a similar amount is made for the fiscal year 1946-47 which begins July 1, 1946. It is assumed that legislative action will be taken within the next month.

Pennsylvania

An $80,000,000 construction program is proposed. All types of surfacing, concrete, flexible and stabilization, will be used.

Pennsylvania Authorizes Plans For Turnpike Extension

The Pennsylvania State Highway Department has authorized Gannett Fleming Cordry and Carpenter, Inc. to proceed with plans for an additional 15 miles of high speed, 4-lane highway to complete the connection from New Stanton on the Turnpike, to Washington, Pa. This company has recently finished their first contract with the State Highway Department for plans covering the 25-mile eastern section of this road.

The new plans are designed on the same specifications as the turnpike. There will be no grade crossings, no curves over 3%, and no grade over 3%. An estimated $5,000,000 construction cost is involved.

East North Central States

Ohio

A 229 project program to cost $32,-422,000 is planned. Status of program on Dec. 15 was:

	Projects	Est. Cost
Ready for bids.....	10	$ 5,052,000
Plans completed, r. w. being secured	6	3,920,000
Surveys completed, plans under way.....	13	8,450,000
Surveys completed, plans not started Surveys underway	40	3,250,000
Surveys not yet started	160	11,750,000

Indiana

Program provides for construction estimated to cost $28,900,000. It includes 199 projects, the types of con-

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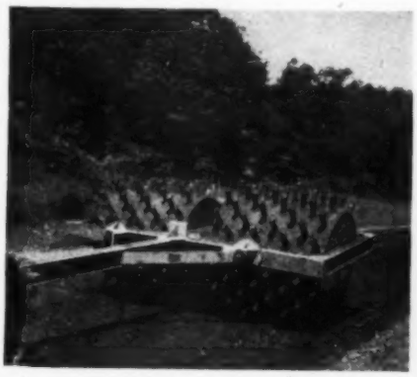
2. Applying Tarvia to Pulverized Soil.

3. Mixing Tarvia and Soil.



4. Consolidating with Sheepsfoot Roller.

5. Final Rolling with Flat Wheel Roller.

6. Applying Tarvia Tack Coat.

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struction being as follows:

	Projects	Miles	Est. Cost
Graded and drained.	7	13	$ 850,000
Gravel or stone surfaced (with bit. palliative)	32	95	5,250,000
Low type bit.	8	8	1,000,000
High type bit.	16	15	875,000
P. c. concrete.	136	169	20,925,000

Michigan

The postwar construction program calls for an expenditure of $140,000,000 in three years. Some 500 projects, including 200 new bridges and grade separations to eliminate dangerous spans and crossings, more than 1,600 miles of reconstruction, many miles of widening and a complete new sign system are in the postwar program. The 1946 construction program is estimated to cost $26,000,000. Plans have been completed for 128 projects that will cost approximately $23,000,000 to build. Plans have been started for an additional 194 projects that would cost an estimated $42,000,000 to build. Surveys have been completed for 64 additional projects and started on 127 other projects.

Wisconsin

It is not possible at this time to make a reasonable estimate of work to be undertaken in 1946. However, plans have been completed for 75 projects estimated to cost $20,000,000. In addition engineering work is underway on 125 other projects estimated to cost $34,000,000.

West North Central States

Minnesota

Estimated construction on rural trunks only is $18,000,000. The work includes grading, 561 miles; paving, 83 miles; stabilized base and bituminous surfacing, 197 miles; bituminous wearing surface, 98 miles. In addition 56 bridges are to be constructed and 45 betterment projects undertaken. It is proposed to spend $2,800,000 on urban trunk highways and $3,000,000 on county Federal aid secondary roads.

Missouri

Tentative construction program provides for letting of contracts estimated to cost $35,278,000. The estimated mileage to be placed under contract is as follows:

	Trunk System Miles	Supplementary Roads Miles
Grading and draining	156.0	1,070.0
P. c. concrete (2-lane)	132.0	1.0
P. c. concrete (4 or more lanes)	7.6	0.0
Bit. concrete surfacing	40.8	0.0
Oiled gravel surfacing	619.3	6.2
Other surface treatment (gravel)	0.0	1,080.0

North Dakota

The status of the 1946 highway construction program on Jan. 1 was as follows:

	Projects	Est. Cost
Ready for bids	14	$ 4,000,000
Plans completed, right-of-way being secured	6	2,000,000
Surveys completed, plans underway	28	7,500,000
Surveys completed, plans not started	8	3,300,000
Surveys underway	1	400,000
Surveys not yet started	16	10,500,000

South Dakota

Proposed construction program amounts to $5,950,000. Of this 19 projects estimated to cost $2,000,000 were ready for bids on Jan. 1 and surveys had been completed and plans were underway for 37 projects to cost $3,950,000. The probable program by types follows:

	Projects	Miles	Est. Cost
Graded and drained.	36	350	$3,500,000
Gravel or stone surfaced	2	22	50,000
High type bit.	20	177	900,000
P. c. concrete.	6	43	1,500,000

Nebraska

Proposed program contemplates expenditure of $7,866,000 on Federal aid system and $5,220,000 on secondary system. Work involves: Grading, 477 miles; gravel surface, 290 miles; concrete paving, 46 miles; bituminous mat (second stage), 114 miles; new bituminous mat, 210 miles; bridges, 61.

Kansas

Construction program proposes expenditures of $20,000,000 on state highway system and $5,300,000 on county secondary Federal aid system. On Dec. 15 construction on state highway system estimated to cost $5,000,000 was ready for bids; plans had been completed for $10,000,000 of work and plans were underway for work to cost $5,000,000. Probable construction program by types follows:

	State System		County Secondary System
	Projects	Miles	Miles
Graded and drained.	80	400	1200
Gravel or stone surfaced	26	170	1600
Low type bit.	14	144	115
High type bit.	64	657	65
P. c. concrete.	34	91	3

South Atlantic States

Delaware

Construction program includes 30 projects, estimated to cost $5,430,000. On Dec. 15, 6 projects to cost $1,040,000 were ready for bids, plans were completed for 5 projects to cost $1,110,000 and plans were underway on 15 projects to cost $2,720,000. The program by types is as follows:

	Projects	Miles	Est. Cost
Low type bit.	1	8	$ 100,000
High type bit.	18	96	3,690,000
P. c. concrete.	4	12	740,000
Bridges	5	..	710,000
Grading only	2	3.4	190,000

Maryland

Proposed construction includes 38 projects, estimated to cost $6,659,200. On Dec. 15 plans were ready for bids on 6 projects to cost $2,717,000, plans had been completed on 3 projects to cost $731,600 and plans were underway on 9 projects to cost $1,467,500. The program by types follows:

	Projects	Miles	Est. Cost
Gravel or stone surfaced	1	3.5	$ 201,800
Low type bit.	11	22.5	457,900
High type bit.	12	18.1	725,500
P. c. concrete.	14	44.4	5,271,000

Virginia

Program calls for improvement of 240 miles of highway. On Dec. 15 plans were ready for bids on 70 projects to cost $17,300,000 and plans were underway for 130 projects to cost $13,000,000. Surveys were underway for an additional 60 projects to cost $11,000,000.

West Virginia

Construction program includes 53 projects, estimated to cost $9,039,750. As of Dec. 15 plans had been completed for 20 of these projects, the estimated cost of which is $3,783,100. The program follows:

	Projects	Miles	Est. Cost
Graded and drained.	3	16	$ 595,100
Gravel or stone surfaced	11	39	1,571,450
Low and high type bit.	18	62	3,183,700
P. c. concrete.	18	24	3,449,500

North Carolina

It is hoped to put under contract this year about $15,000,000 of construction of various kinds. In addition the state highway department is to do a considerable amount of betterment work on secondary roads with its own forces and equipment. The department has let to contract since the ending of the war about $4,000,000 of construction work. It has plans either completed or approximately so for $6,000,000 to $7,000,000 of additional work.

South Carolina

Construction program includes 150 projects, estimated to cost $20,000,000. On Dec. 15, 83 projects to cost $11,000,000 were ready for bids. Plans had been completed on 12 projects to cost $2,000,000 and plans were underway on 32 other projects to cost $5,200,000. The program calls for grading, draining and bituminous surfacing of 128 projects (840 miles) estimated to cost $18,393,000 and bituminous surfacing only of 22 projects (150 miles) estimated to cost $1,607,000.

Georgia

It is estimated that 312.4 miles of highway on primary systems and 364

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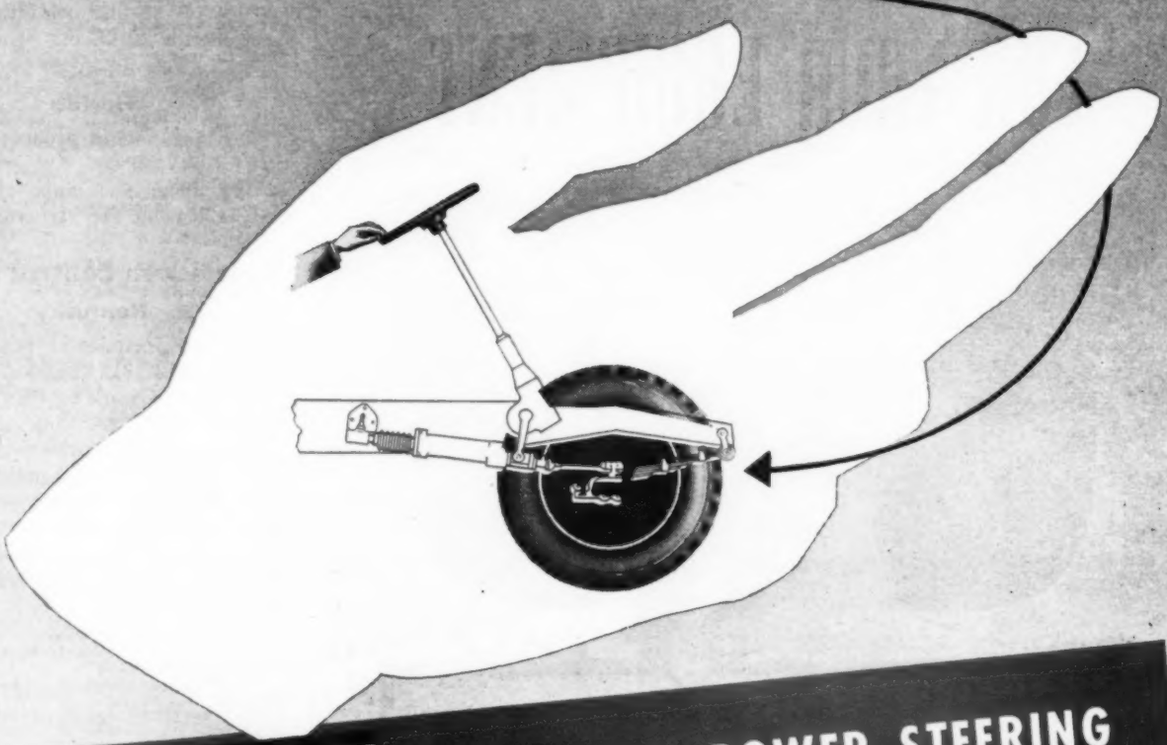

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miles of secondary roads will be placed under contract this year. The work on the primary system includes 291 miles, 45 bridges (total length 3 miles), and 18 miles of urban road, including 10 bridges. The status on 1946 construction as of Dec. 26 follows:

	Projects	Est. Cost
Ready for bids	15	$3,899,031
Plans completed, r. w. secured	31	2,022,319
Surveys completed, plans under way	61	6,560,110
Surveys completed, plans not started	14	2,852,004
Surveys under way	39	1,736,536
Surveys not yet started	90	8,930,000

Florida

The 1946 budget proposes expenditure of $17,930,000 for grading and paving about 650 miles of highway and $4,554,000 for structures.

East South Central States

Kentucky

Program includes 81 projects, estimated to cost $18,770,000. Status of this proposed work on Dec. 15 was as follows: Ready for bids, 15 projects, to cost $3,600,000; plans completed, right of way being secured, 25 projects, $6,000,000; surveys completed, plans underway, 35 projects, $8,300,000; surveys not started, 6 projects, $870,000. The program by construction types follows:

	Projects	Miles	Est. Cost
Graded and drained and gravel or stone	26	125	$7,400,000
Bridges	9	..	2,200,000
Low type bit.	22	325	3,300,000
High type pavements	16	125	5,403,000

Alabama

Improvement of 633 miles of highway is called for in the 1946 program, which includes 79 projects, estimated to cost $13,233,000. The work includes 53 projects (246 miles) of bituminous surface treatment, estimated to cost $3,149,000, and 5 projects (32 miles) Portland cement concrete, to cost $1,205,000. The majority of the other projects cover graded and drained highways. A letting was held Jan. 26 which included 48 miles of grading and drainage, 18 miles concrete and 24 miles bituminous surface treatment.

Mississippi

The three-year program calls for the expenditure of approximately $53,000,000. Plans had been completed on Dec. 15 for about $3,500,000 worth of work and it was expected to complete plans for more than $1,000,000 worth of work per month during 1946.

West South Central States

Arkansas

The 1946 construction program in-

cludes 50 projects, estimated to cost $10,880,000. The status of these projects on Dec. 15 was as follows: Ready for bids, 9 projects, $2,345,000; plans completed, right of way being secured, 10, $2,740,000; surveys completed, plans not started, 3, $545,000; surveys under way, 4, $820,000; surveys not started, 6, $995,000.

Louisiana

It is estimated that $24,711,818 will be expended for construction, maintenance and operation. The new construction includes 63 miles of concrete, 22 miles bituminous surfacing, 5 miles aggregate surfacing, and 15 miles of bridges.

Oklahoma

Plans are practically completed for a construction program totaling $15,000,000. Estimate of types shows:

	Miles
Graded and drained	375
Gravel surfaced	275
Low type bit.	50
High type bit.	13
P. c. concrete	37

Texas

The construction program calls for an expenditure of $64,000,000, which covers 125 projects. The status of these projects on Dec. 15 was as follows: Ready for bids, 40, $20,000,000; plans completed, right of way being secured, 50, $25,000,000; surveys done, plans underway, 30, $15,000,000; surveys underway, 5, $4,000,000.

Mountain States

Montana

Construction program amounts to $19,230,800. Of this, 14 projects, totaling 51 miles and estimated to cost $2,389,300 are already under contract. Program calls for construction as follows:

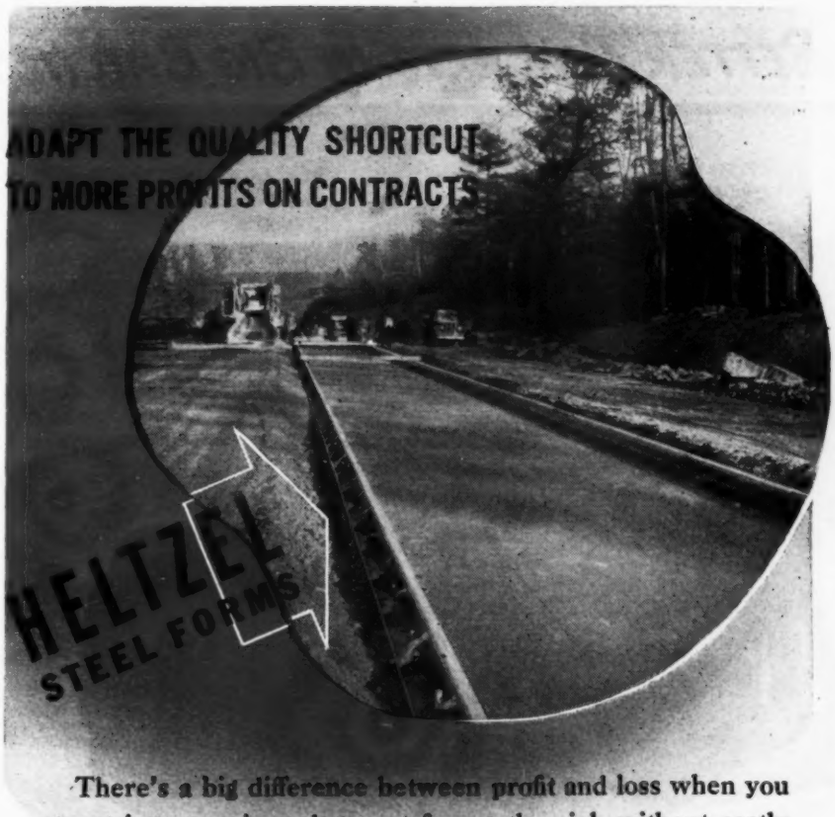
	Projects	Miles	Est. Cost
Graded and drained	5	30	$1,027,000
Graveled and stone surfaced	52	499	8,294,000
Low type bit.	58	279	8,321,800
Bridges	7	1.5	570,000
Grade separation	8	3	991,000
Signals	5	..	27,000

Idaho

The 1946 program calls for the grading, draining and surfacing with gravel or stone of 154 miles of highway (27 projects) at an estimated cost of $6,656,000. In addition there will be 4 projects for low type bituminous surfacing, 31 miles in all, to cost $764,000 and 116 miles (21 projects) of high type bituminous construction, to cost $5,522,000. There also will be 2 projects for Portland cement concrete, 7 miles in all, to cost $370,000.

Wyoming

Highway construction to cost $6,720,000 and structures to cost $625,000 are provided in the 1946 program.



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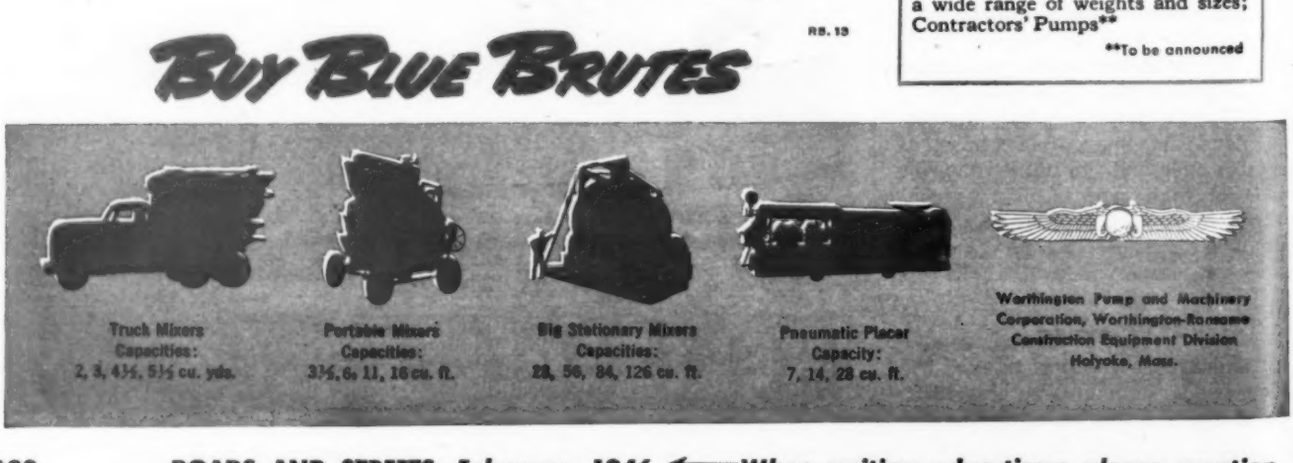

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See ad on page 100 for list of equipment in each line

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Holyoke, Massachusetts

The work includes 302 miles of grading and draining, of which 150 miles is on secondary roads, and 113 miles of oiled gravel surfacing, 75 miles of this being on secondary roads.

Colorado

Of the proposed $19,900,000 construction program, 45 projects estimated to cost $6,000,000 were ready for bids on Dec. 15. In addition, on the above date, surveys had been completed and plans were underway on 39 projects to cost $5,500,000 and surveys were underway on 95 projects to cost $8,400,000. All these projects are to be finally finished with low type bituminous.

Arizona

The program calls for the construction of 12 miles high type pavement. In addition 147 miles of intermediate type, to cost $4,850,000; and 57 miles low type, to cost $1,190,000, are proposed for construction.

Utah

The program calls for construction of 42 projects at total estimated cost of $5,890,000. By types these projects are:

	Projects	Miles	Est. Cost
Graded and drained.	3	24	$ 656,000
Gravel surfaced ...	7	64	705,000
Low type bit.....	22	128	2,435,000
High type bit.....	1	.6	121.000
Dual (P.c.c. & Bit.)	2	9.9	1,159,000
Structures & paved app.	7	.9	814,000

Signals, highway planning service, etc., increase total to $5,995,000 of which Federal funds are $4,330,000.

Nevada

Twenty-seven projects estimated to cost $5,119,000 were ready for bids on Dec. 15. The work included 3 projects for gravel surfaced roads, 69 miles in all, estimated to cost $655,000 and 24 projects for low type bituminous surface (163 miles) estimated to cost $4,364,700. In addition on the above date surveys had been completed and plans were underway for 37 projects (304 miles) estimated to cost $7,611,000; surveys had been completed but plans not started on 4 projects (87 miles) estimated to cost $1,740,000; surveys were underway on 3 projects (21 miles) estimated to cost $420,000.

Pacific States

Washington

A road construction program, estimated to cost $14,045,000, is proposed for 1946. In addition it is proposed to construct structures to cost $2,798,000. This year's highway program includes the following: Graded and drained, 328 miles, of which 172 miles are on secondary roads; Portland cement concrete, 25 miles; bituminous concrete, 16 miles; oiled gravel surfacing, 417 miles.

Oregon

The 1946 highway construction program includes 150 projects, estimated to cost $24,000,000. By types these are:

(*Continued on page* 123)

Improving

Engineer-Contractor Relationship

4—Presenting the final step in a plan by which a supervisory employee can improve his handling of problems on the job. The previous steps: gathering facts; weighing and deciding; taking proper action

By H. K. Glidden,
Eastern Editor, Roads and Streets, N. Y.

Step IV—CHECK RESULTS

As was explained early in this article series, its intention is to provide engineers with a definite, step-by-step plan for handling any project given them for accomplishment. Assuming the plan is followed religiously, the engineer will need to follow through on each step and will also want to determine the merits of using the plan.

The engineers' follow-up problem is entirely different from that of the supervisor for whom the U. S. Civil Service Commission devised the job relations plan. The supervisor can usually take his action so that it covers a very short period of time and will, therefore, in most instances, require no follow-up on the action while it is being taken. The supervisor's follow-up usually comes after the action has been completed. The engineer will want to check results both of the action taken under Step

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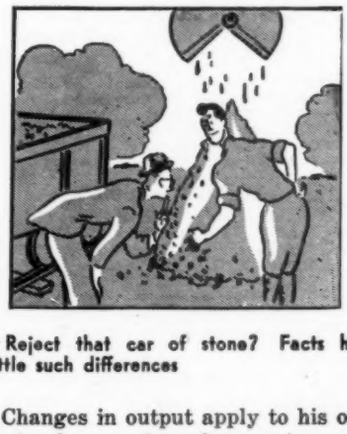
III and the merits of using the plan while the project is under way, as well as after it is completed.

(a) How Soon and How Often Will You Follow Up?

The engineer will want to follow up immediately after the contract is awarded and will normally maintain a constant check on the appropriateness of the action he called for in his plans and specifications throughout the entire course of the construction.

(b) Watch for Changes in Output, Attitudes and Relationships

In following up and checking, the engineer will watch for changes in certain things to indicate to him whether the project is going better than previous projects have, and whether following this plan proved worthwhile.



★ Reject that car of stone? Facts help settle such differences

Changes in output apply to his own work of preparing plans and specifications, as well as to the actual work performed by the contractor. The engineer can readily tell whether or not his plans and specifications artistically portray the job to be done, and whether or not the picture was painted with dispatch and without several false starts. Improvement in his own output will be noticeable by the lack of last minute changes of a major nature; lack of costly revisions, or scrapping of completed drawings; lack of doubts as to the most appropriate action to be taken; lack of complaints or receipt of sarcastically worded inquiries on the part of prospective bidders, and in a positive manner by the receipt of reasonable and balanced

quotations from the bidders.

It will be relatively easy for the engineer to determine whether or not the contractor's on-the-job output was improved. The improvement will show up by the contractor keeping up his production schedule, a lack of the necessity for clarifying major requirements of the contract, a lack of argument as to the manner in which the work should be performed, a lack of argument as to the method of measurement or payment, and by an orderly job, efficiently handled which, in most cases, is completed on time. There will be many more positive indications of increased output which the engineer's follow-up will reveal to him.

The engineer will be intensely interested in the attitude shown by his subordinates, the owner and the contractor. The attitudes of these people are important as they reflect the regard and esteem felt for the engineer and for the product of his labors. Improved attitudes can most surely be taken as an indication of improved engineering and will go a long way toward making the engineer's work more of pleasure.

Did Your Action Help Production?

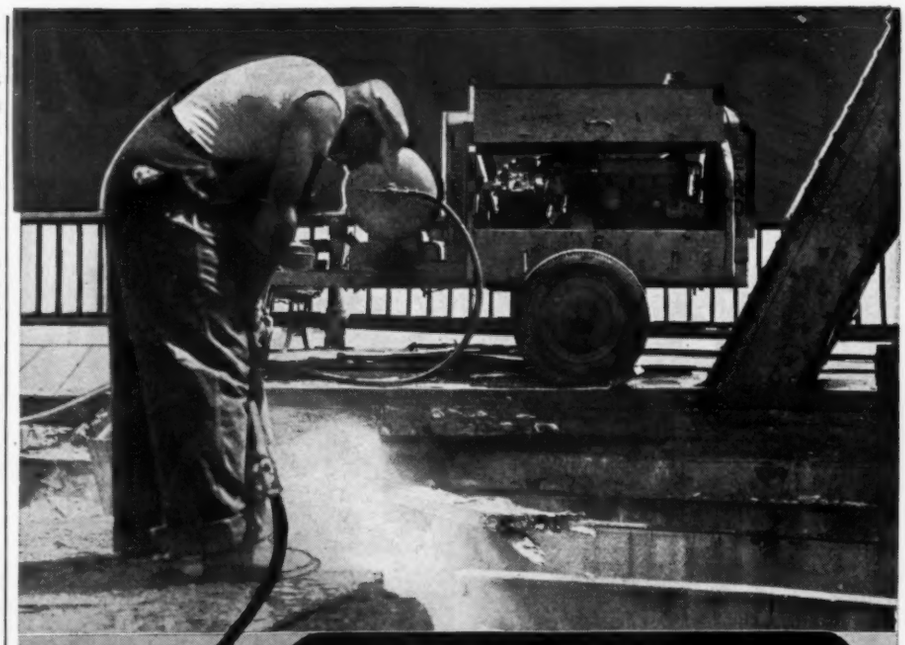
In the final analysis the engineer's answer to this question will largely determine whether he considers the plan herein presented of any assistance to him. When he decides whether his plans and specifications were prepared better and with less confusion and whether the action he took enabled the contractor to proceed with his work with a minimum of changes, confusion and arguments, he will know in his own mind whether this plan is worth following. When, in the application of the plan to a job relations problem, the action taken by the supervisor does not help production this poor result is considered to indicate that the supervisor neglected to follow some part of the plan or failed to use what are called the "Foundations For Good Relations." These four foundation principles are as follows:

JOB RELATIONS
A Superior Gets Results Through People
Foundations for Good Relations

1. Let each worker know how he is getting along. Figure out what you expect of him. Point out to him ways to improve.

2. Give credit when due. Recognize extra or unusual performance. Tell him while its fresh.

(*Continued on page* 125)



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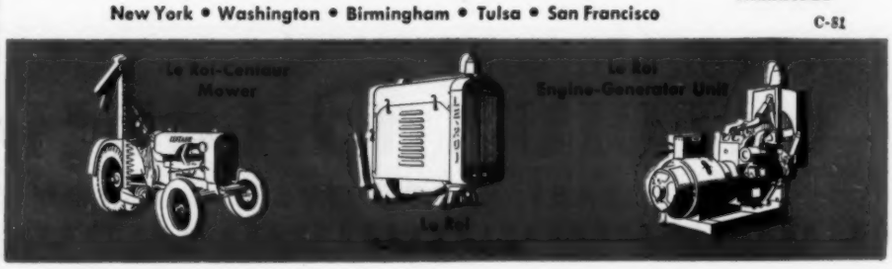

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Low Temperature Sludge

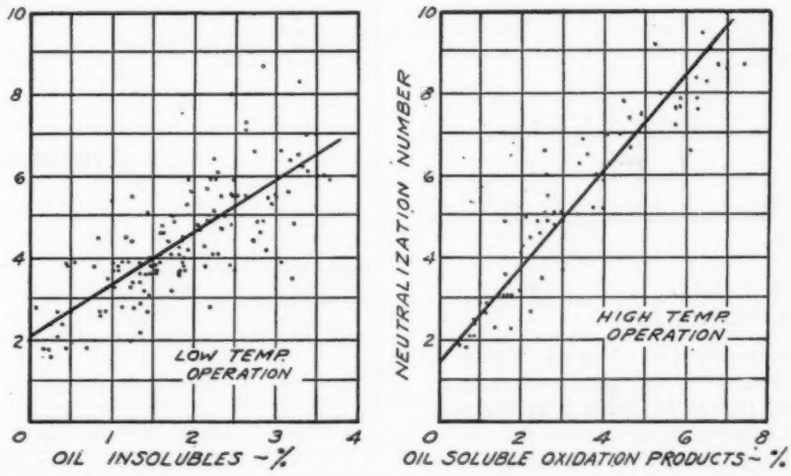
in Automotive Gasoline Engines

The Texas Company's publication of "Lubrication" reports further studies which we are reprinting below

THE problem of sludge in gasoline engines is almost as old as the engine itself. Two types of sludge have been recognized for many years; that associated with high temperature operation and attendant oxidation of the lubricating oil, and that associated with low temperature operation wherein the so-called mayonnaise or emulsion type deposit is developed. Although such difficulties have prevailed in automotive equipment for many years, restrictions imposed by wartime regulations along with inadequate maintenance personnel, shortage of replacement parts, heavier schedules and other operational obstacles have collectively aggravated the formation of sludge and focussed attention on this problem.

Extensive investigations have been carried out toward minimizing engine deposits and oil oxidation occurring under high temperature operating conditions; solution through the use of heavy duty oils has been generally satisfactory. Low temperature operations have not received this comprehensive attention and thus many operators have suffered as a result of engine deposits from operating conditions normally considered to be mild. As will be discussed later, however, these "mild" conditions are actually more severe in some respects than many high temperature operations.

Laboratory engine tests have been developed to simulate low temperature service conditions and have been employed in a comprehensive study of the low temperature sludge problem. Much of the information to be presented subsequently has been obtained from these laboratory investigations. The operating conditions employed in this test procedure will be discussed later.



★ Fig. 1. Relation of used oil characteristics

Nature and Method of Formation

Deposit Analyses

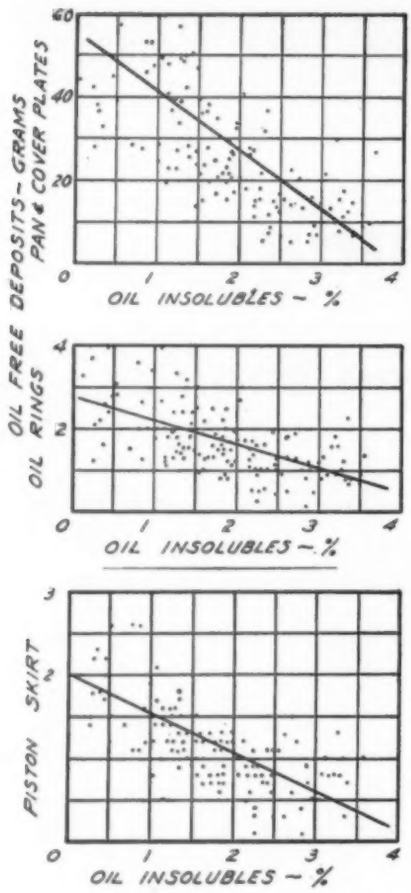
It is often difficult to determine the cause of engine deposits from their analyses alone since most service operations involve both low and high temperature conditions.

Examination of deposits from laboratory engines known to have operated exclusively under low temperature conditions shows that on an oil-free basis they are composed primarily of fuel diluent, water and free mineral matter (lead compounds from fuel combustion, and iron and other metals occasioned by engine wear and rusting), along with lesser quantities of carbonaceous material and oxidation products. An analysis of such deposits is shown in Table I along with similar analysis from service operations. The latter case demonstrates the difficulty of identifying low temperature deposits and recommending corrective measures on the basis of deposit analysis alone. This is due to the fact that most service operations are conducted with high temperatures prevailing during some portion of the operation, thereby baking existing deposits and supplementing them with oil oxidation products.

Used Oil Characteristics

Used oil from both low and high temperature operation often exhibits a high neutralization number. In the first case oil deterioration is negligible and the high neutralization number is associated with the oil insolubles originating from the combustion chamber; in the latter case, the high neutralization number results from oxidation of the lubricating oil.

Extended low temperature operation is reflected in unusual characteristics of the used oil which differ from those resulting from high tempera-



★ Fig. 2. Relation between oil insolubles and engine deposits

ture operation as shown in Table II. In the case of low temperature operation, it will be noted that the neutralization number is relatively high, thus suggesting that extensive oil oxidation had occurred. However, from exhaustive laboratory tests, it is known that negligible oil deterioration occurs at the low temperatures employed (as evidenced by low percentage of oil soluble oxidation products) indicating that the high neutralization number resulted from material originating from some other source. The amount of oil insolubles, consisting of incomplete combustion residues, is also high. After clarification (removal of insolubles) the neutralization number is greatly decreased, indicating that the material responsible for this high value is associated with these insolubles. This is further substantiated by the very high neutralization number of the insolubles themselves.

In the case of high temperature operation, it will be noted that the neutralization number is also high. Since the oil soluble oxidation products have a very high neutralization number and are present in large quantity it is evident that most of the material contributing to the high neutralization number originates from oxidation of the lubricating oil. Removal of the oil insolubles, which are present in minor quantities, by clarification reduces the neutralization number only slightly, it remaining relatively high due to the presence of the soluble oxidation products.

The foregoing discussion is demonstrated by Fig. 1, which shows that for low temperature operation, the neutralization number is associated with oil insolubles originating from combustion residues, while for high temperature operation, it is associated with oil soluble oxidation products resulting from deterioration of the lubricating oil itself.

Table I
Typical Engine Deposit Analyses

Deposit Componets (Oil-free basis)	Average from Low Temperature Laboratory Engine Tests	Typical Field Sample
Diluent, %	20.3	14.8
Water, %	51.5	9.1
Oxidation Products, %	8.2	34.2
Free Carbon and Carbonaceous, %	3.7	21.7
Free Mineral Matter, %	16.3	20.2
Total, %	100.0	100.0

material is largely water insoluble indicating high molecular weight with oil oxidation as its source.

It is significant that the nature of the neutralizable materials formed in low temperature operation has not been found corrosive to "alloy" bearings while in high temperature service, these materials are generally corrosive.

Engine Deposits vs. Oil Insolubles

The amount of oil insoluble materials produced with a given fuel under any set of low temperature operating conditions is approximately constant. The relative amount of these materials deposited on the engine parts or remaining in the oil, to be drained at the oil change period, depends upon the ability of the oil to retain them in suspension.

It was previously pointed out that with low temperature operation, contaminants from the combustion chamber evidence themselves as insoluble material in the lubricating oil and as

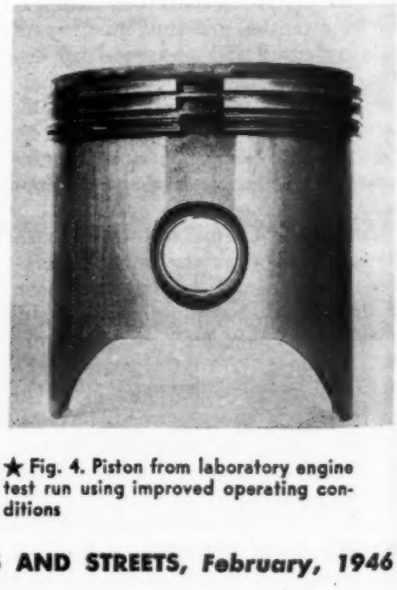
Table II
Typical Used Oil Analyses

	New Oil	Following Low Temperature Operation		Following High Temperature Operation	
		As Drained	After Clarification	As Drained	After Clarification
Neutralization Number	0.06	4.7	1.2	5.2	3.9
Dilution, %	0	15.8	15.8	0	0
Oil Insolubles, %	0	2.07	0	1.16	0
Oil Soluble Oxidation Products, %	0	0.20	0.20	3.09	3.09
Neut. No. on Oil Insolubles	...	17.2	...	28.8	...
Neut. No. on Sol. Ox. Prod.	...	...*	...*	63.2	63.2

*Quantity of oxidation products insufficient for analysis.

Additional information in regard to origin and distribution of the neutralizable material causing the neutralization number in used oil is shown in Table III. It is apparent that in the case of low temperature operation a majority of the material is water soluble, indicating it to be of low molecular weight and evidently originating from the fuel. With high temperature operation, however, the deposits on various engine parts. Experience has shown that most of the deposits accumulate in the oil pan and valve compartments; oil ring and piston skirt deposits are small in comparison. The latter, however, are considered to be very important since they contribute directly to poor oil control, spark plug fouling and piston seizure.

★ Fig. 3. Piston from typical laboratory engine low temperature reference run



★ Fig. 4. Piston from laboratory engine test run using improved operating conditions

It is not difficult to determine quantitatively deposits present on piston skirts, in oil rings and on oil pan and cover plate surfaces. In fact, such determinations are made on nearly all laboratory engine tests. Fig. 2 is a plot of results from low temperature laboratory engine tests showing the relationships between oil insolubles and the above mentioned deposits which are normally measured. It will be noted that as oil insolubles increase engine deposits decrease. From the intercepts of these curves it appears that when engine deposits become zero, so that all contaminants are in the oil, an oil insoluble content somewhere between 3.9 and 4.8% (average 4.3%) would result. Basis this average value and a normal oil drain of 4 quarts (3178 grams), an average total oil insoluble content of 137 grams is determined. As a check on this line of reasoning, ten runs were made and deposits carefully determined for all engine parts. Average results of these tests are shown in Table IV, compared with values predicted from Fig. 2 as outlined above; the agreement is remarkably good.

Table III
Distribution of Neutralizable Material in Used Oil

Per Cent of Total Neutralizable Material Soluble in	Low Temperature Operation	High Temperature Operation
Diluent	5	0
Water	58	17
Residual Oil*	37	83

*Diluent and water-free but containing insolubles and soluble oxidation products.

Corrective Measures

Low temperature sludge can be alleviated by employing heavy-duty oils and by altering operating techniques.

It is evident from the foregoing discussion that low temperature sludge is largely the result of contaminating the lubricating oil with extraneous matter originating from incomplete combustion of the fuel oxidation products. Since the oil itself is not oxidized or otherwise altered to any appreciable extent, it is not responsible for originating such deposits. It is evident at present that two practical means of alleviating the difficulty present themselves, and to obtain best results, both should be employed.

1. Use lubricating oils which are capable of keeping contaminants in finely divided suspension rather than permitting them to be deposited on engine parts.

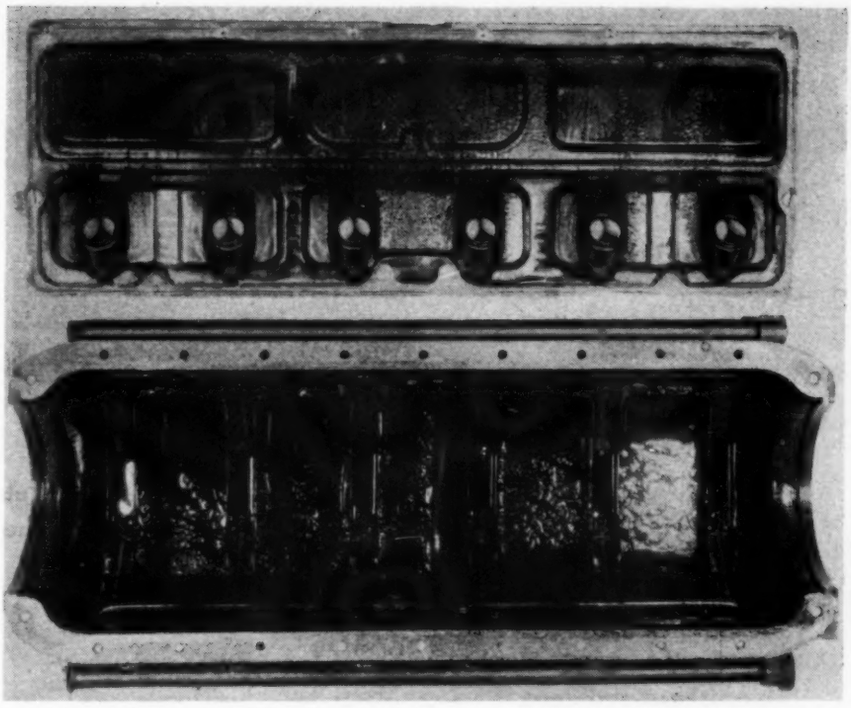
2. Alter operating techniques thereby minimizing the formation of these contaminants.

Table IV
Distribution of Engine Deposits

	Predicted From Figure 2	Average of 10 Runs
Oil insolubles, per cent	1.72	1.72
Total Oil Insolubles, grams	54.8*	57.4
Piston Skirt Deposits, grams	1.2	1.3
Oil Ring Deposits, grams	1.8	1.7
Oil Pan and Cover Plate Deposits, grams	31.0	27.8
Block, Valve Compartment and All Other Parts Deposits, grams.	48.2**	38.3
Total Engine Deposits + Oil Insolubles, grams	137.0	126.5

*Basis 4 quarts (3178 grams) oil drained $\frac{3178 \times 1.72}{100} = 54.8$.

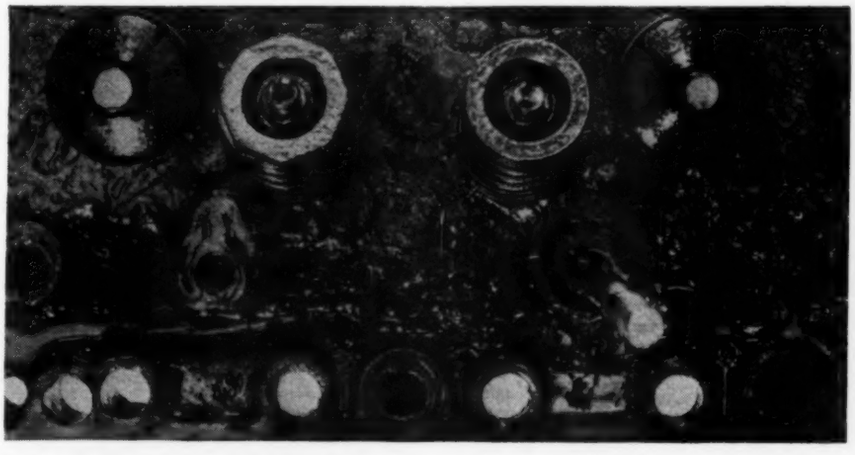
**By difference.



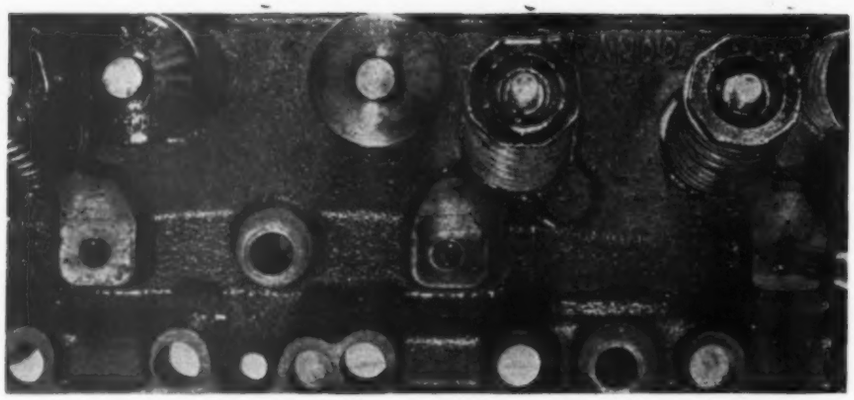
★ Fig. 5. Oil pan, push rod cover and oil pump screen from typical laboratory engine low temperature reference run

Table V
Comparison of Service and Laboratory Tests

Deposit Components (Oil-free Basis)	Average for Vehicles	Average from Laboratory Engine Tests
Diluent, %	25.4	20.3
Water, %	32.4	31.5
Oxidation Products, %	5.4	8.2
Free Carbon and Carbonaceous, %	9.2	3.7
Free Mineral Matter, %	27.6	16.3
Total, %	100.0	100.0
Used Oil Analyses	**Average for Vehicles (2000-Mile Basis)**	**Average from 2000-Mile Laboratory Engine Tests**
Neutralization Number	2.7	4.2
Dilution, %	10.7	17.1
Oil Insolubles, %	2.06	1.99
Oil Soluble Oxidation Products, %	0.15	0.21



★ Fig. 6. Valve chamber from typical laboratory engine low temperature reference run



★ Fig. 7. Valve chamber from laboratory engine test run using improved operating conditions

An extensive program of laboratory engine tests covering fuels, lubricating oils and operating variables, was conducted to substantiate the concepts presented above.

Laboratory Engine Tests

Operating Conditions

The operating conditions employed in this accelerated laboratory test were developed to simulate in only 40 hours (2000 miles) of engine operation the results from a fleet of 35 passenger cars and trucks operated for a long period in service known to be predominantly low temperature. Table V compares the results of engine deposit and used oil analyses from this fleet and from the laboratory engine tests. It is evident that the results are similar, although the laboratory test is more severe.

The basic test conditions are outlined in Table VI: regular grade motor fuel containing the maximum permissible amount of tetraethyl lead was used. Constant engine performance is insured throughout each series of tests by employing reference runs, under the conditions outlined, before and after each test run; results of test runs are compared with these reference runs.

Table VI
Laboratory Engine Test Conditions

Engine	1942 Chevrolet
Fuel	Regular grade. Maximum TEL
Oil	SAE 20, 95 VI, Straight Mineral
Speed, rpm	2500
Load, BHP	45
Jacket Temperature, °F.	95
Crankcase Oil Temperature, °F.	155
Intake Manifold Temperature, °F.	95
Ambient Temperature, °F.	Room (aver. 90° F.)
Crankcase Ventilation, cu. ft. air/min.	1.0
Air-Fuel Ratio	14.5
Test Duration, hours.	40 (2000 miles)
Oil Changes	None
Oil Filter	None

Evaluation of Test Results

Comparisons are accomplished by weighing piston skirt, oil ring and pan and cover plate deposits and rating those from the test run on the basis of an assigned value of 100 for the average of the two reference runs. For example, assume that piston skirt deposits from a test run amount to 0.7 grams and the average from preceding and succeeding reference runs is 1.4 grams, then the piston deposit rating for the test run is

$$\frac{0.7}{1.4} \times 100 = 50$$

Table VII
Results of Laboratory Engine Low Temperature Sludge Tests

Phase of Investigation	Relative Deposit Weight, % Piston Skirts	Oil Rings	Oil Pan and Cover Plates
Lubricating Oil			
Straight Mineral (reference)	100	100	100
Heavy Duty (A)	81	37	56
Heavy Duty (B)	88	43	19
Jacket Temperature (regular test, 90° F. aver. ambient)			
95° F. (reference)	100	100	100
120	68	33	66
180	51	35	28
Jacket Temperature (500 rpm idle, 0° F. ambient)			
80° F. (reference)	Trace	Trace	100
120	Trace	Trace	9
160	Trace	Trace	19
Crankcase Oil Temperature			
155° F. (reference)	100	100	100
180	82	53	67
225	180	58	192
265	88	94	45
Intake Manifold Temperature			
70° F.	101	133	250
95 (reference)	100	100	100
160	55	50	77
190	44	41	58
Air-Fuel Ratio			
18.2:1	120	68	150
14.5 (reference)	100	100	100
10.5	74	6	13
Lubricating Oil Viscosity			
SAE 10	100	83	112
" 20 (reference)	100	100	100
" 30	76	41	56
" 50	52	31	37
Oil Change Period			
40 hours (reference)	100	100	100
10 "	58	72	53
5 "	34	...	22
2.5 "	15	...	13
Oil Filter (cotton waste, full flow, large capacity)			
None (reference)	100	100	100
Case without element	62	79	39
Complete with element (no changes)	54	68	16
Oil Filter (cotton waste, by-pass)			
None (reference)	100	100	100
No element changes	87	99	104
Element change at 20 hours	136	84	41
Crankcase Ventilation			
1 cfm (reference)	100	100	100
3 "	121	77	55
1 " reversed flow	139	110	109
3 " reversed flow	111	137	88
Diluent and Water Extractor			
None (reference)	100	100	100
Extractor with 5 qts./hr. oil flow	116	137	250
Extractor with 25 qts./hr. oil flow	92	137	50
Improved Operating Conditions			
None (reference)	100	100	100
With conditions changed from those in Table VI in following respects: Oil—Heavy Duty (SAE 20) Jacket Temperature—160° F. Crankcase Oil Temp.—130° F. Intake Manifold Temp.—150° F. Oil Changes—20 Hours Oil Filter—Yes Oil Filter Element Changes—20 hours	18	11	10

In addition to such comparisons, photographs of various engine parts are taken for each run. Figs. 3, 5 and 6 show the dirty condition of engine parts following a typical reference run, while Figs. 4, 7 and 8 show similar parts following a test run demonstrating the vastly improved performance which can be obtained by simple operational changes.

Test Results

Results of investigations to alleviate low temperature sludge through modifications in fuel, lubricating oil and operating conditions are summarized in Table VII. These modifications will be discussed separately below and considered with respect to their service application.

Fuel

Inasmuch as low temperature deposits are associated with incomplete combustion of oxidation products originating from the fuel, which are thought to form resinous material insoluble in the oil, it follows that the fuel employed should have some bearing on the formation of such deposits. The part played by fuels in this connection is currently under investigation. With the incomplete information available and the problem still far from solution, it is not possible to draw conclusions or make practical recommendations at the present time.

Lubricating Oils

Heavy-duty oils will reduce engine deposits in some respects, however, they do not comprise a complete solution.

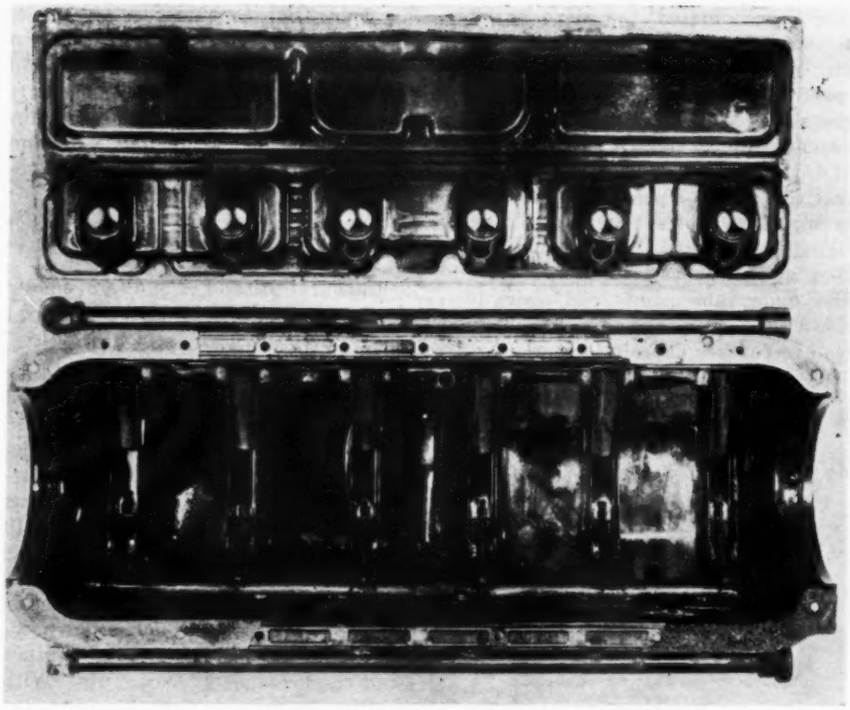
Since lubricating oils of the heavy-duty type possess the ability to retain insoluble matter in suspension, they would be expected to show a reduction in low temperature sludge formation. The data in Table VII indicate that use of these oils, although not a complete solution to the problem, results in improved performance, particularly in regard to reduction of oil ring, oil pan and cover plate deposits.

Jacket Temperature

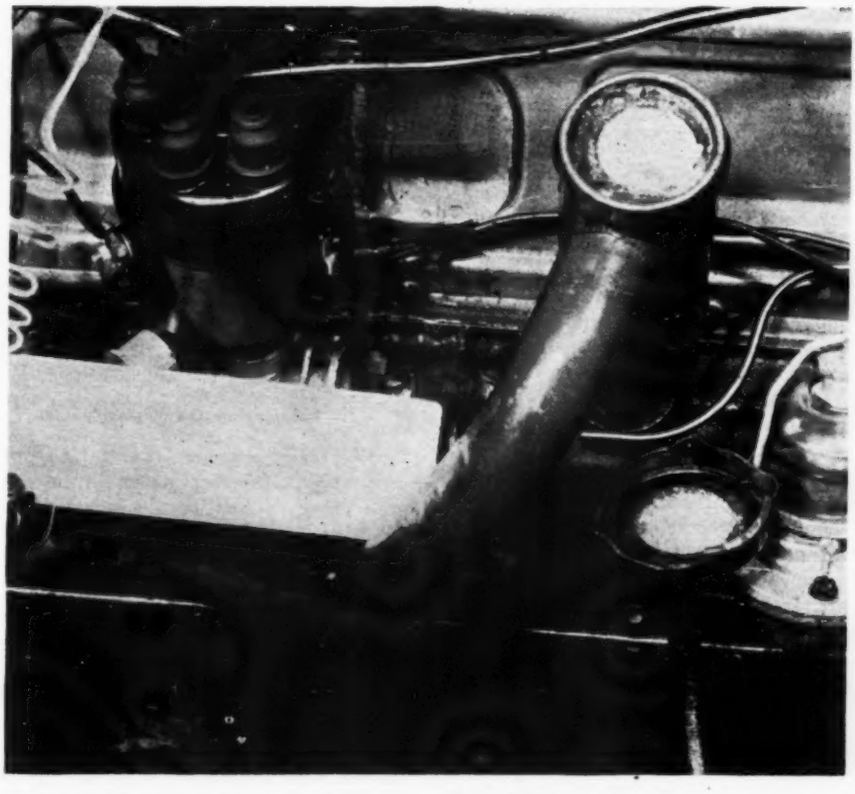
Operating jacket temperatures in the 160-180° *F. range should be maintained at all times. Where engines are idled overnight, jacket temperatures should also be maintained in this range if possible. Better still, operations would be improved by not idling at all.*

Tests made under the regular conditions outlined in Table VI at jacket temperatures from 95 to 180° F. demonstrate that increasing jacket temperature to 120° F. results in considerable improvement; further increase to 180° F. results in a still greater reduction in engine deposits.

Further runs were conducted in a cold room at 0° F. with the engine idled for 40 hours thereby simulating the winter practice employed by some operators to idle their engines overnight when stored outdoors. Jacket temperature was varied from 80 to 160° F. with results paralleling those mentioned above. Throughout these runs a crankcase oil temperature of approximately 90° F. was observed. In this case, an increase in jacket temperature to 120° F. or above

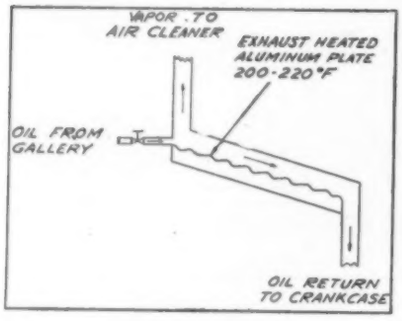


★ Fig. 8. Oil pan, push rod cover and oil pump screen from laboratory engine test run using improved operating conditions



★ Fig. 9. Frozen condition of breather pipe resulting from engine idling in cold room at zero °F.

largely eliminated the deposits obtained at 80° F. It will be noted that this operation produced only pan and cover plate deposits; pistons and oil rings were substantially clean, apparently due to their low temperature and the washing action of the excessive diluent present. However, even under the most favorable conditions investigated considerable dilution and oil contamination occurred and upon subsequent road operation these materials would undoubtedly lead to further deposit formation.



★ Fig. 10. Schematic diagram of diluent and water extractor

Crankcase Oil Temperature

Crankcase oil temperature should be maintained at approximately 180° F. in order to minimize deposits. Temperatures above or below this value appear to aggravate engine deposits.

An increase in crankcase oil temperature from 155 to 180° F. results in a significant improvement in operation, particularly in regard to reduction of oil ring and pan and cover plate deposits. With further raising of oil temperature to 225° F., a general increase in deposits is observed over those obtained at 155 and 180° F. This is due to the fact that at this oil temperature the deposits are composed of both high and low temperature materials, thereby producing a combined effect resulting in a dirtier engine. At 265° F. an analogous situation exists except that in this case low temperature materials are minimized with resultant reduction in deposits from those obtained at 225° F.

Intake Manifold Temperature

Intake manifold temperature should be maintained at the highest value possible consistent with freedom from manifold deposits.

Since engine deposits are associated with poor combustion of the fuel, any measures taken to improve combustion (such as increasing intake mixture temperature) would be expected to improve performance. Intake mixture temperatures from 70 to 190° F. were investigated. It will be observed in Table VII that increasing intake manifold temperature results in a consistent and substantial reduction in the engine deposits measured. It is of interest to note that at manifold temperatures of 160° F. and higher, carbon-like deposits were observed in the intake manifold.

Air-Fuel Ratio

Carburetors and air filters should be maintained in good condition by conforming to best service practices.

Since air-fuel ratio is known to alter combustion it should be expected that changes in air-fuel ratio would influence low temperature engine deposits. Tests were conducted at air-fuel ratios ranging from a lean value of 18.2:1 to a rich value of 10.5:1. In the case of lean mixtures, deposits are generally increased over those obtained at normal mixtures, possibly due to intermediate combustion products with this slower burning mixture and the presence of excess air. With rich mixtures engine deposits are greatly reduced. Since extensive fuel dilution occurs with such mixtures the reduction of deposits is apparently associated with the washing action of the diluent as well as with possible changes in combustion occasioned by a deficiency of air.

In actual service rich mixtures are not very practical because of fuel economy, while lean mixtures lead to detonation and preignition with their attendant serious difficulties. It thus appears that alleviation of the low temperature sludge problem through carburetion is not feasible. However, carburetion equipment should be maintained in good condition.

Lubricating Oil Viscosity

The most viscous lubricating oil consistent with starting requirements and other factors should be used.

Although a wide choice in oil viscosity is not always possible due to starting limitations and other factors, it was considered desirable to ascertain the effect of viscosity on engine deposits. Tests were conducted on lubricating oils ranging from SAE 10 to 50. The data in Table VII indicate that a consistent improvement is realized with increased viscosity. It is possible that the more viscous oils may contribute to improved performance through improved piston-cylinder seal. However, improvement is primarily a result of the ability of the heavier oils to hold more contaminants in suspension to be drained with the used oil rather than deposited throughout the engine. This characteristic is indicated by the following data obtained on the used oil from these tests.

SAE Grade	*Oil Insolubles %*
10	0.87
20	1.27
30	1.50
50	2.66

Oil Change Period

All efforts should be made to change oil as frequently as possible consistent with allowable costs and maintenance schedules.

Previous discussion pointed out that under low temperature conditions negligible oil oxidation occurs and contaminants are present largely as oil insolubles. If these materials were frequently removed, improved performance should result. Accordingly, tests were conducted varying oil drains from the normal 40 hours (2000 miles) to as low as 2½ hours (125 miles). It is evident from data in Table VII that there is a marked reduction in engine deposits with more frequent oil changes.

Oil Filter

Reduction of engine deposits can be obtained by the use of an efficient full flow filter. However, the standard by-pass type is effective provided frequent element changes are employed.

Further tests in regard to efficient removal of oil contaminants were carried out with a full flow filter whereby all of the oil leaving the pump is passed through the unit before reaching the engine. In view of the large capacity of this filter (3 gallons) the extra oil required was considered by conducting tests using the filter case alone. The results shown in Table VII indicate some improvement in performance due to the additional oil and some additional improvement with the complete unit.

Although efficient filtration of the oil greatly reduced engine deposits, full flow filters are generally considered to be impractical in service. Accordingly, tests were made with a regular size filter operating on the normal by-pass principle. Results indicate that without element change during the entire 40-hour period, little if any improvement in engine condition results. However, with the element changed at 20 hours, improvement is realized, with respect to oil pan and cover plate deposits. No reasonable explanation is available to account for the increased piston deposits.

Crankcase Ventilation

Every effort should be made to keep the crankcase ventilation system clean, in operable condition and as warm as possible to alleviate stop-

Is your Job too tough for your truck?...

No matter how little it cost when new—if your truck is not tough enough for your job *it will cost too much in the end.*

There's only one "bargain" in trucking—and that's *extra work for your money.*

This is why Mack trucks are built the way they are. It's why, for instance, Mack uses Tetrapoid rather than conventional gears—rubber Shock Insulators rather than conventional spring shackles—wrist pins precision-finished to two ten-thousandths of an inch.

When you build a truck this way *it gives its owner extra work.* It stays on the job *longer.* It is in the repair shop *less. It costs less in the end.*

If your trucks give you too much trouble—if repair costs are excessive and service interruptions too frequent—then ask yourself if maybe you're not just using *too little truck for the job!*

If the answer's "*Yes!*"—then you need a Mack. It pays off in work on the job.

★ **BUY THAT VICTORY BOND TODAY** ★

Mack Trucks, Inc., Empire State Building, New York 1, N. Y. Factories at Allentown, Pa.; Plainfield, N. J.; New Brunswick, N. J.; Long Island City, N. Y. Factory branches and dealers in all principal cities for service and parts.

Mack
TRUCKS
FOR EVERY PURPOSE

Performance Counts!

page due to freezing. Changes in crankcase ventilation are sometimes desirable. However, any alteration in the normal arrangement should be undertaken with great caution.

It was previously explained that engine deposits are associated with combustion contaminants consisting of water, fuel diluent and insoluble matter. Since some of the diluent and water vapor can be removed by crankcase ventilation, tests were conducted to investigate the effect of such ventilation on engine deposits.

Crankcase ventilation in the laboratory test engine is normally from the overhead valve compartment downward with exit from the crankcase breather pipe. With normal test conditions, air is metered through this system at the rate of 1 cu. ft./min. thereby simulating road service. It will be observed in Table VII that an increase in crankcase ventilation from 1 to 3 cu. ft./min. reduces deposits to some extent, on the oil rings and pan and cover plates. In similar tests with the direction of air flow reversed, heavy engine deposits are experienced.

One further point which is usually not recognized in service operation is the possibility of breather system freezing. Fig. 9 shows the condition of the breather system following one of the cold room tests mentioned previously. The system in this case was rendered completely inoperative due to accumulation of "snow" in the breather pipe. Note also the ice formation below the breather outlet.

Diluent and Water Extractor

Further investigations in regard to water and fuel diluent removal were conducted with the laboratory unit shown in Fig. 10 designed to remove these materials from the crankcase oil during engine operation. From Table VII it appears that with sufficiently high oil flow some improvement in oil pan and cover plate deposits may be obtained.

Devices of this nature are reported to be beneficial in some operations; their merits should be carefully determined for the particular service involved.

Improved Operating Conditions

Marked reduction in engine deposits can be realized through employing heavy duty oil, high engine temperature, frequent oil changes and a suitable oil filter with frequent element replacements.

From the foregoing discussions it is evident that low temperature deposits can be alleviated to some extent by changes in oil, fuel and various operating conditions. As an overall test of *some* of these corrective measures, a run was made with the standard conditions outlined in Table VI modified as indicated in Table VII. The results shown therein demonstrate the effectiveness of the alterations investigated. The engine was substantially clean at the conclusion of the run, as evidenced by Figs. 4, 7 and 8. Employment of other aids such as increased oil viscosity, and better crankcase ventilation are additional possibilities for still further deposit reduction.

Conclusion

Great strides are being made towards overcoming the problem of low temperature sludge not only by the petroleum industry but by the engine manufacturers and fleet operators as well. With the knowledge that this type of sludge is not caused by the engine lubricating oil, engine manufacturers are giving careful consideration to the design of their new engines. Fleet operators are accepting the responsibility imposed by the maintenance and control of mechanical and operating variables affecting this condition. Through these combined efforts everyone is benefitting.

OTC
MAINTENANCE TOOLS
for
FAST REPAIRS
on the Job or
in the Shop
The OTC PULLING SYSTEM makes quick work of removing and replacing gears, bearings, sleeves, wheels, pulleys, shafts and other close-fitting parts—without damage to machinery, without back-straining labor. Approved by Hyatt, M-R-C, New Departure, SKF and Timken for use on their bearings. Portable . . . as effective for field maintenance and repairs as for shop use.
To meet YOUR Needs—OTC GRIPOMATIC PULLERS, PUSH-PULLERS, Pulling Attachments and Adaptors. Heavy Duty BOX WRENCHES and Special Tools are made in a wide range of sizes and types.
OTC Maintenance Bulletin shows some of the many time-saving uses of OTC TOOLS. Write for a copy.
OWATONNA TOOL CO., 319 Cedar St., Owatonna, Minn.
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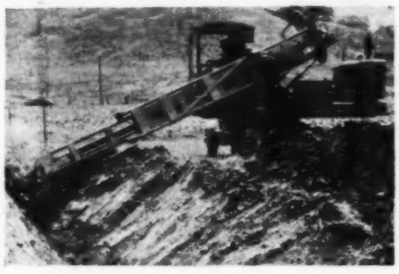
GRIPOMATIC
PUSH-PULLERS
Heavy Duty BOX WRENCHES
SLEDGING WRENCHES, SPECIAL TOOLS

Postwar Parade

of New Construction Equipment and Materials

New Grading Machine

1. The Warner & Swasey Co., Machine Tool Builders, Cleveland, O., are entering the road machinery field with the manufacture and sale of a new grading machine trade-named "Gradall." The machine, which is of a design which permits earth-moving in places not ordinarily accessible to previous types of excavating equipment, was invented by Ray Ferwerda, a Cleveland contractor, and the Warner & Swasey Co. is licensed to build



Gradall Grading Machine

the machine under his patents. Hydraulically operated, the machine has an expandable 24-ft. boom of arc welded construction. Five of these machines previously built have for some months been tested out on a variety of work in the Cleveland area. Field results have convinced Warner & Swasey Co. that this machine will be an excellent item to supplement its regular machine tool business. The "Gradall" machine will be sold through distributors in the road machinery field.

New Dual Batching Plant

2. A new development for road builders recently announced by The C. S. Johnson Co., Champaign, Ill., provides for dual batchings of aggregates. The aggregate bin is of the portable section type, of 100 cu. yd. capacity, divided into three compartments, with hinged leg sections for fast erection and moving. Two multiple material batchers of 34E paver-batch capacity are so located that a single operator can handle both batchers. The batchers are discharged simultaneously into the separate compartments of 2-batch trucks. To further increase batching efficiency, dual cement batchers are provided for in Johnson bulk cement plants, including the Dutch Mill, the Portable Section, and the Twin Silo units. The Twin Silo has also been recently developed to provide storage capacity up to 1610 bbls. of cement, and is the largest portable unit in the Johnson line.

New 11-S Mixer

3. A new 11-S Kwik-Mix Dandie concrete mixer has been announced by the Kwik-Mix Co., Port Washington., Wis. The 11-S Kwik-Mix Dandie completes the entirely redesigned line of Kwik-Mix Dandie mixers which also includes new 6-S and 16-S sizes. The new 11-S Kwik-Mix Dandie follows the general design of the previously announced Dandie mixers. Tilted flow-line discharge chute, selective skip shaker and the Kwik-Mix remixing drum are included. High strength steel is used at all points of wear. The 11-S Kwik-Mix Dandie has a rated capacity of 11 cu. ft. of mixed concrete plus 10 per cent and complies with A.G.C. specifications. The machine will be furnished either on four wheels with side or end discharge, or on two wheels with end discharge.

Mail Inserted Card

for data on equipment described on these pages

New 34-E Dual Drum Paver

4. After exhaustive field tests, the Foote Co., Inc., Nunda, N. Y., has announced the Multi-Foote Duomix, a 34-E dual drum paver which is stated to incorporate a number of new features in a paver of this size. Fully automatic control is reported to cut down charging, transfer, and discharging time to a minimum. On one pilot test which involved paving of a 6-mile reconstruction project, the paver is stated to have turned out 10 per cent oversize batches (37.4 cu. ft.) every 35 seconds. The Multi-Foote Duomix traveling mechanism is driven from the single main shaft, which also provides power for the drums and skip hoist. Drive gears are fully enclosed and run in oil. There

Duomix 34-E Dual Drum Paver

are two speeds forward and reverse. A new type of tread plate is used on the crawlers which is of such construction that it is impossible for stones to lodge in the joints between treads to cause "nutcracker" action. In addition, drive lugs on the treads are on alternate sides of adjacent treads, providing a clean, smooth path that conforms to the arc of the roller with a ball-and-socket action that distributes the bearing pressure evenly, regardless of ground conditions. Transfer and discharge chutes are ro-

JACKSON VIBRATORY PAVING TUBES

Now Better THAN EVER

Carriage frame from which the dual vibratory tubes are flexibly suspended, completely isolating all vibration from the finisher.

Powerful submersible vibratory motor rigidly attached to each set of dual vibratory tubes.

Dual vibratory tube members shown elevated above slab after first pass. In operation they are lowered well within slab. Depth adjustable as job conditions indicate.

IMPORTANT NEW IMPROVEMENTS

QUICK ADJUSTMENTS from 10' to 25' Widths (in the field)

Simplified carriage frame makes changes from one width to another extremely quick, simple and easy.

LOWER SUBMERSION HIGHER LIFTS

Perfect adaptability to slabs 16" to 24" thick, without affecting the efficiency on single or two-course standard plain or reinforced concrete pavement construction, has been achieved by giving the vibratory elements lower submersibility and higher lift above the finished slab.

DOUBLE FUNCTIONING

Horizontal full width submersible vibratory elements are standard as shown. As alternate or auxiliary equipment, however, we can furnish vertically mounted unit vibrators of the internal type in any spacing specified, thus making it possible for the contractor to meet all specifications with one machine.

Plus ALL THE ADVANTAGES THAT HAVE MADE THIS PAVING TUBE AN OUTSTANDING FAVORITE

1. Faster finisher progress in drier mixes.
2. Perfect puddling of concrete at forms and joints.
3. Complete compaction — excellent finish.
4. Reduction in spreading cost.
5. Instant transformation of stiff, dry mixes into plastic, easily placed concrete.
6. Dependable, proved performance. Finger-tip control.
7. Ample reserve power through entire variable frequency range of 3000 to 5000 VPM.

You're way ahead of the parade when you own a JACKSON! See your JACKSON distributor or write for complete information.

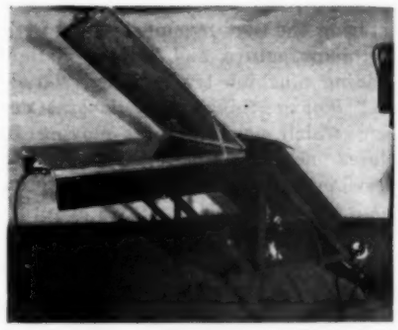
Manufactured by ELECTRIC TAMPER & EQUIPMENT CO. *for*

JACKSON VIBRATORS INC. Ludington, Mich.

tary type, requiring only a quarter turn from completely shut to wide open positions. Drums are both of the Multi-Foote double-cone design which has proved highly satisfactory on single-drum Multi-Foote 27-E's and 34-E's. Unusually smooth operation is attributed to careful weight distribution and balanced overall design.

Machine for Reflectorizing Signs

5. A completely new method for reflectorizing every type of embossed traffic sign has been developed by the Minnesota Mining and Manufacturing Co., St. Paul, Minn., makers of "Scotchlite" reflective material. Called the "Scotchlite" vacuum applicator, this machine is stated to reflectorize



"Scotchlite" Vacuum Applicator

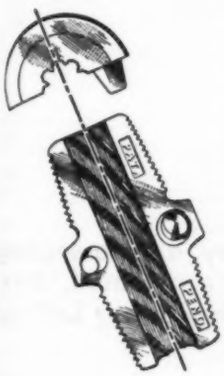
signs in 3½ minutes. The use of atmospheric pressure on a diaphragm over an air-tight enclosure, molds the "Scotchlite" reflective material to every part of the sign surface. While intended primarily for applying "Scotchlite" to embossed signs, this applicator is said to be equally efficient on all flat surfaces. The applicator can be successfully operated by anyone without previous experience.

New Air Hose

6. Innovations in processing rubber hose, developed by The Goodyear Tire & Rubber Co., Akron, O., to provide bullet-sealing fuel hose for airplanes in World War II have paved the way for a new peacetime air hose. The new hose is manufactured under an exclusive method of bonding cover, carcass and tube together with much greater adhesion-strength than previously obtainable. Result of this new process is claimed to give a lighter hose with much thinner wall gauge but far greater ruggedness, flexibility and longer life than other hose of equal inside diameters. It is manufactured in light, medium and heavy-duty types, providing a wide range of adaptability to various jobs.

SAFE-LINE
WIRE ROPE CLAMP
Never Slips

FASTER - SAFER - ELIMINATES SPLICING



FORGED AND MASTER COINED TO FIT ROPE
SIZES 1/16" TO 3/4"

Safe-Line double spiral splines fit each wire and strand, providing a *never slip* grip, without cutting action to the rope. Replacement guarantee on clamp against breakage and fracture.

Millions in daily use prove *Safe-Line* the right way to hold wire rope securely. It's the better way, too!

Better because *Safe-Lines* are faster than splicing and serving, or using U-bolts.

Better because *Safe-Lines* outpull the strongest rope, hold a tight thimble, minimize rope or sling breakage.

Better because *Safe-Lines* are easy to use and re-adjust, without special tools or skilled labor.

Better too, because *Safe-Lines* enclose sharp wire ends, preventing personal injury and mental hazards.

Try this better way that saves you time and money.

APPROVED BY UNDERWRITERS' LABORATORIES AND CIVIL AERONAUTICS ADMINISTRATION

WRITE FOR DESCRIPTIVE PRICE-LIST FOLDER

NATIONAL PRODUCTION COMPANY
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What is your roadbuilding problem?

Get in touch with the

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Metropolitan Paving Brick Co.
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Stone Creek, Ohio

The Paving Brick Institute was recently formed to act as a centralized bureau for all who want more information on this most permanent and satisfactory road material—*brick*.

Get in touch with this organization—secure the latest technical and engineering data—and learn the newest practices in the design and construction of roads and streets.

The Institute is affiliated with the internationally known Structural Clay Products Institute. Member companies, listed on the left, are ready to serve you.

•

PAVING BRICK INSTITUTE
1756 K Street N. W., Washington 6, D. C.

Three New Scrapers

7. Production of three open-bowl scrapers, matched in capacity to the power of "Caterpillar" diesel tractors, and built to perform with them as a

New "Caterpillar" Scraper

complete earthmoving package has been announced by Caterpillar Tractor Co., Peoria, Ill. The new scrapers, designated as Nos. 80, 70 and 60, have respective struck measures of 13.8, 8.7 and 6.0 cu. yd. The many features of the scrapers, pointed out by the manufacturer, include: Open-bowl design for greater stability, visibility and access for shovel or dragline loading. High apron lift to clear the stickiest materials. Positive, clean ejection. Long cable life from correct reeving, over-sized precision-grooved sheaves. Double-curved, self-sharpening cutting edges for "live loading" with longer boiling action, digging hard material, shorter loading distance and less loading time. Optional tire sizes for correct flotation, tires matched to the job, minimum rolling resistance, bigger pay-loads and longer tire life.

New Portable Welder

8. A new portable welder of the gasoline engine-driven type has been announced by The Lincoln Electric Co., Cleveland, O. This 200 ampere welder measures 24 by 48 by 30 in., and weighs 660 lb. Among its features are: Provision is made on the output panel for three ranges of output current, continuous adjustment within these ranges being obtained by means of a simple speed control. Generator controls are mounted inside an enclosed cabinet above the generator, cooling being through a fan mounted on the generator shaft. The welder is powered by a Wisconsin air cooled 4 cylinder V-type engine. Shrouds around the engine fan and cylinders direct the cooling air. The speed of the engine determines the

New "Shield Arc Jr." Welder

welding current which is controlled by adjusting the engine speed between a maximum of 2100 revolutions per minute (22 HP) and 1500 revolutions per minute (16HP).

New Paving Breaker

9. A paving breaker with a new safety latch has been added to the line of the Gardner-Denver Co., Quincy, Ill. This safety latch makes it possible to move the breaker from place to place without shutting off the air and without danger of injury to the operator. Other features claimed for the unit include: It is

Announcing **PREFORMED**

Bāseal

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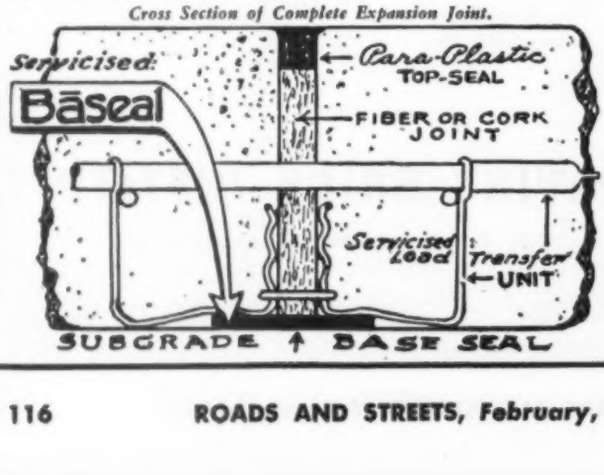
A SUBGRADE WATERSTOP!

Baseal is the latest contribution by Servicised to the Road Building Industry, a base-sealing strip as the name implies—new in purpose, performance, and design. A preformed, flexible, adhesive strip in a roll. Stops infiltration at the Danger Point at bottom of every Lateral Expansion Joint.

SELF BONDING

Baseal has this outstanding quality that after the wet concrete is poured on, sets up and becomes dry, a permanent bond is formed with the Baseal, which results in a perfect watertight joint between the two adjoining slabs and the base strip.

Cross Section of Complete Expansion Joint.



TIME AND LABOR SAVED

Baseal is a pliable adhesive strip of one quarter inch thickness, and of width (usually 3 to 8 inches) and lengths to conform to width of paving slab. A very important feature of Baseal is its high degree of cohesive, adhesive, resilient and permanent plastic properties. It is easily handled, and installed. Supplied in convenient roll form, each strip is treated to prevent pieces from sticking together in shipment or storage.

Send for Details and Specifications.

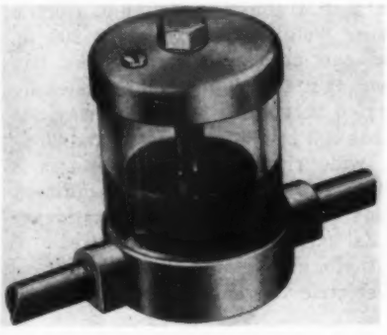
SERVICISED PRODUCTS CORP.

6051 West 65th Street, CHICAGO 38, ILL.

shorter from top of gad to holding handles; joints are not under air pressure; built-in lubricator holds enough oil for 5 hours; heated air cannot cause discomfort to operator because air inlet is at side; no need to replace entire chuck end when chuck wears to a loose fit of the gad shank; extra heavy forged tool retainer pivots on substantial pin held positively in place; convertible to a sheeting driver by removing the standard chuck end and substituting a jaw-type sheeting driver head.

New Air Tool Lubricator

10. A new lubricator, specially designed for automatic lubrication of a wide variety of pneumatic equipment, has been announced by CCA Products Engineering, Glendale, Calif. Features include a full view, non-breakable transparent plastic window with "O" rings for top and bottom seals. Quantity of oil in the lubricator is



CCA Lube

visible at all times. Regulation of lubricant is accomplished by a needle valve located on the air outlet side. This "Lube-Mist" regulator is easily adjustable to meet varying equipment requirements. The filler cap and adjusting aperture is located directly above the regulator valve. Since the Lube works only when air operated equipment is in use, the device is fully automatic, permitting only the correct amount of oil to mix with working air.

New Diesel Driven Welder

11. A new diesel engine driven welder of 300 ampere capacity specially made for use in locations where electrical power is not available, or not economical, has been announced by Lincoln Electric Co., Cleveland, O. Engine features include a simplified fuel arrangement with complete fuel filtering system, and many other special features. Equipped with dual continuous control, the welder permits the operator to select any type of arc

"Repair 'em with a KOTAL Mix!"

There's a world of difference between ordinary cold mixes and KOTAL cold mixes! There's a difference *when* the mix is laid and a difference *after* the mix is laid.

Ordinary cold mix repair jobs can be done only in good, dry weather and with fresh-made mix. KOTAL Master Mixes can be laid in any kind of weather—rain or snow, as long as men can work—and from the winter stock pile.

Ordinary cold mix repairs are temporary—must be done again in the fall or next spring. A KOTAL job is practically permanent. KOTAL Master Mix paving often lasts for years.

Eight Working Features of KOTAL Master Mixes

EASY TO USE. Quickly mixed, ready to lay. No preheating or drying.
STABILITY. Cure quickly and permanently. Do not shift, ravel or pick up. Open sooner to traffic.
WORKABILITY. Do not adhere to equipment. Work easily.
LONG-TERM STOCK PILES. Can be stock-piled for many months without losing workability.
SAVE TIME. Quickly made stock piles ready for immediate use without frequent fresh mixes.
SAVE LABOR. Actual road records prove fewer labor hours required.
SAVE MONEY. Savings in time and labor mean economies in road costs.
EXTEND PAVING SEASON. All-weather workability permits more months of operation.

Write for your copy of booklet which tells the story of KOTAL Master Mixes. We will also send you the name of your nearest supplier.

MASTER MIXES KOTAL **KOTAL COMPANY ★ 52 Vanderbilt Ave. ★ New York 17**

KOTAL *Master Mixes*

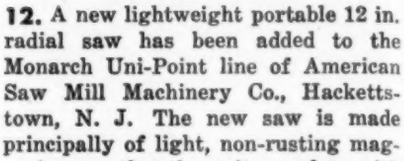
The Advanced All-Weather Aid in Building Better Roads

New Diesel Driven Welder

and any arc intensity to suit the job. Other features of the welding generator include separate excitation and laminated magnetic circuit for a smoother, more productive arc at all current values. The welding generator has N.E.M.A. rating, 300 amperes at 40 volts. Current range for welding duty is from 20 to 40 volts, 60 to 375 amperes. The new welder (stationary model) weighs 2,560 lb. and can be readily mounted on wheels, trailer or truck for easy portability. Optional equipment includes spring mounted running gear of automobile trailer type with four wheel pneumatic tires.

New Portable Saw

12. A new lightweight portable 12 in. radial saw has been added to the Monarch Uni-Point line of American Saw Mill Machinery Co., Hackettstown, N. J. The new saw is made principally of light, non-rusting magnesium, so that the unit complete with



New 12-in. Radial Saw

carrying frame and 1½ h.p. electric motor weighs approximately 200 lb. and can be carried readily by two men. It is so compact that it is easily carried through a 30-in. doorway, yet it has a 3 by 16-in. crosscut and 20½-in. wide ripping capacity, and it is stated it will handle all the different kinds of work that heavy stationary radial saws will do. It can be carried and plugged in anywhere that there is electric current.

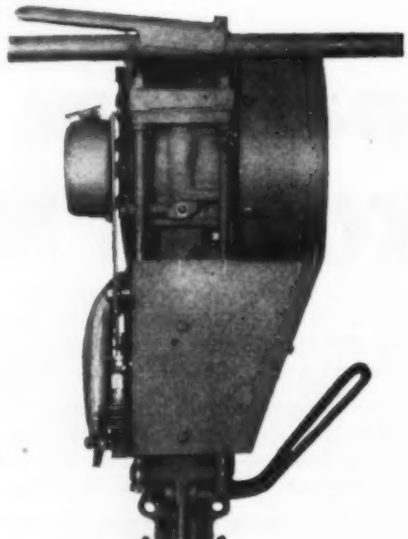
New 1-Ton General Purpose Truck

13. A sturdy full-size 4-wheel drive, 1-ton general purpose truck is now in production by the Dodge Division of Chrysler Corporation. It is designed both for economical "off-the-highway" use and operations over unimproved roads where ordinary trucks are re-

New General Purpose Truck

stricted in their operations. It was adapted from the 4-wheel drive Dodge military vehicle. Engineered for rigorous general purpose uses, it has a 94 HP engine 4-speed transmission, 2-speed transfer case, a conventional closed cab with built-in driver comfort, a steel express body 8 ft. long, 4½ ft. wide and 22¼ in. high with

A ONE-MAN CREW
THAT WILL **SAVE MONEY** FOR YOU



100% Self-Contained
SYNTRON
Gasoline Hammer

PAVING BREAKERS

BUSTING concrete—**DIGGING** shale, clay and frozen ground.
CUTTING asphalt—**TAMPING**—and a host of other jobs.

Write for catalog folder No. 8-45

SYNTRON CO., 384 Lexington, Homer City, Pa.

special reinforced stake pockets, a double-drop frame with side rail reinforcements, 126-in. wheelbase and choice of 9.00/16 or 7.50/16 8-ply tires. It is designed for a maximum payload of 3,000 lb. with 9.00/16 tires. A dual power take-off is available to deliver 536 r.p.m. at the tail shaft to operate many types of machinery or drive a 9-in. diameter belt pulley drive to power many items of auxiliary equipment at a belt speed of 3,124 ft. per minute. The power take-off also operates a front-mounted power winch of 7500-lb. capacity.

MANUFACTURERS' LITERATURE

Hauling Unit

14. The Mississippi wagon which has 4-axle construction and hydraulic weight transfer from trailer to tractor, is illustrated and described in a circular issued by M-R-S Manufacturing Co., Jackson, Miss. The important features that make for easy, efficient operation of the wagon are pictured and explained. Specifications are included.

Dipper Teeth

15. All types of DMCO teeth for dippers and dragline buckets are pictured and described, with complete specifications, in a bulletin issued by Daniels-Murtaugh Co., Cedar Rapids, Ia. Featured is the DMCO wear-sharp penetrater point of forged alloy steel, which is double-keyed to a weldapter tooth and held by tack welding. These penetraters provide a sharp thin cutting edge.

Arc Welding Electrodes

16. Its complete, postwar line of arc welding electrodes is announced in a folder released by Hobart Brothers Co., Troy, O. The folder furnishes description, application, procedure, physical properties of deposited metal, and sizes available for each type electrode.

Arc Welding Accessories

17. A complete new line of arc welding accessories is described and illustrated in a folder released by Hobart Brothers Co., Troy, O. All, and many difficult to find items are properly identified with catalog numbers for simplification in ordering.

Tournacrane

18. Various on- and off-the-road uses of the tournacrane are described in a folder issued by R. G. Le Tourneau, Inc., Peoria, Ill. It presents on-the-job photographs of various tournacrane applications. In addition, a handy chart showing tournacrane lifting capacities at various reaches is included.

Automatic Clutch

19. Details of its new automatic clutch are described in detail in a bulletin of Salisbury Motors, Inc., Los Angeles, Calif. Designed for operating loads up to 6 h.p., this clutch is stated to operate smoothly and easily to absorb momentary overload, and to eliminate starting shock and arrive quickly at driving speed.

Contractors Pumps

20. "Marlow Mud Hogs" are described in a bulletin published by Marlow Pumps, Ridgewood, N. J. These diaphram pumps are available in 3 in. and 4 in. single and 4 in. double sizes, with capacities from 3,000 to 9,000 gal. per hour.

DOUBLE LIFT-ARMS

For DOUBLE LIFTING ADVANTAGES

Rugged, double, compound type lifting arms apply the power of the PERFECTION Hydraulic Hoist to the dump body. They permit directing the power thrust against the dump body at a point as near to the center of the load as practicable. The result is a more efficient utilization of power from the hoist and speedier lifting operation--yet with such a smooth action that power shock and stresses are practically eliminated. The lifting arms are widely spaced to reduce body sway.

This construction, together with PERFECTION'S balanced power thrust and cushion-drop mechanism assures you longer service and more satisfactory operation.

For all makes of trucks. Write for Bulletin and names of nearest Distributors.

THE PERFECTION STEEL BODY CO. GALION, OHIO

PERFECTION

TRUCK BODIES AND HOISTS

Wire Rope

21. The first of a series of nine educational bulletins, compiled by Union Wire Rope Corporation, Kansas City, Mo., to provide a reference index for users of wire rope, is now available. The series is comprehensive in illustrating the most efficient care and handling of wire rope, not only to increase its service life but also of the equipment it is used with. The first bulletin covers "Replacement of Wire Rope," as to size, tread, diameter and type of construction. Those requesting this bulletin will automatically receive the additional issues at frequent intervals.

Welded Fabrication

22. A new manual issued by The United Welding Co., Middleton, O., discusses the factors affecting the choice of welded fabrication and the techniques of welded design. The purpose of the manual is to help engineers and designers decide for themselves if fabrication by welding and the materials made available by this method are applicable to the problem.

Stone Crusher

23. A double impeller stone crusher, stated to be capable of reducing aggregate from 30 in. to minus 1 in. in one operation is pictured and described in a circular issued by New Holland Machine Co., New Holland, Pa. Important features of the crushers are shown and illustrations are included showing how it works.

Air Separator

24. The Airfuge combination air separator and trap for users of compressed air tools and operations is discussed in a bulletin of The Swartwout Co., Cleveland, O. It discusses need for clean, dry air for the protection of pneumatic equipment.

Cleaning Unit

25. The Oakite-Vapor heavy duty cleaning unit for construction equipment is illustrated and described in a circular of Oakite Products, Inc. This is a self-contained enclosed coil-type steam generator that delivers hot vaporized cleaning solutions under separate pressures up to 200 lbs.

Black Top Equipment

26. Equipment for construction and repair of highways is described in a folder issued by Littleford Bros., Inc., Cincinnati, O. Descriptions and illustrations are given: of kettles with hand-spray or motor-spray attachments and with barrel hoist; of the trail-o-roller; of utility spray tanks, and emulsion sprayers.

Nickel Alloys

27. International Nickel Co., Inc., revised List "A" of current publications on nickel alloy steels, nickel cast irons, nickel brass and bronzes, and nickel plating is now available. Publications offered cover the production, fabrication, properties and uses of nickel alloys for industrial applications, and the production, properties and use of nickel electrodeposits.

Diesel Engines

28. A 24-page color booklet, "Diesels with Endurance," published by Caterpillar Tractor Co., Peoria, Ill. spotlights the durability of highway con-

FIRST AND FOREMOST featuring

Welded Steel Construction!

WELLMAN

Williams Type BUCKETS

The best type of bucket construction is welded rolled steel. Wellman Williams buckets are so built—a pioneering Wellman achievement. You get sturdier buckets, less breakage, better service at lower cost!

THE WELLMAN ENGINEERING CO.
7003 Central Avenue • Cleveland 4, Ohio
Sales and Service Agencies in Principal Cities

SEND FOR BULLETIN

struction and maintenance machinery over long periods of operation. Replete with action pictures of veteran "Caterpillar" Diesel units, the book presents an interesting portrayal of endurance marks by machines, some of which are no longer on the production line, but are still serving after 15,000 to 50,000 heavy duty hours.

"Lubricating Oil Additives"

29. Equipment engineers and contractors' personnel charged with equipment operation and maintenance will be interested in an article on lubricating oil additives, published in the January, 1946, issue of Texaco's magazine, "Lubrication." This article defines additives, describes their function and importance, and analyzes the manner in which they work and results of tests. There are sections on additives designed respectively to prevent oxidation of motor oil, prevent corrosion at high temperatures, or act as deturgents or cleansers; also as pressure agents, pour point depressants, and viscosity improvers.

Free copy of "Lubrication" available on request to the Texas Company, 135 East 42nd St., New York 17, N. Y.

Front End Loader

30. The front-end wheel tractor attachment of the Lull Manufacturing Co., Minneapolis, Minn., is illustrated and described in a circular. Specifications are given. In addition, pictures and descriptive matter on many interchangeable attachments, including such items as rotary brooms, combination bulldozer and 1-way snow plow, are included in the circular.

•

(*Continued from page* 78)

and mid-year 1946 may see machinery development and production approaching a reasonable pace. Machinery manufacturers will try to deserve your patience. In most cases the backorder pile may carry through to 1947. You may be forced to use your old equipment much longer than you had planned for. Yet it is our feeling that your patience will be gratified by a new peacetime precision in production and a more rugged quality of performance.

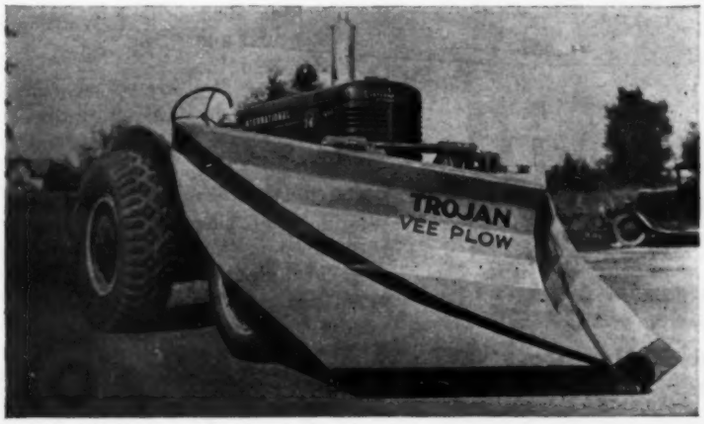
To measure progress by model in any given category would be unfair. To evaluate expanded lines by make would be both unfair and misleading. To accentuate the war birth of newcomers would not be fair dealing for the tried and true. To imply that the war had brought on a maturity in development would be fictitious. On the contrary, the war has given us many new ideas that seem promising but may require years of tough testing. Least of all should we become excited over the possibility of obsolescence at this time.

Whether our backlog in general construction has been accurately estimated or not, peacetime activity will call for the use of our machinery in new and ever expanding fields. This does not mean that we should break away from our moorings but that we should make our moorings more comprehensive. The next adequate Road Show, for instance, should be a welcoming open house to all construction trades and including the public, where stimulated vision may easily become our greatest asset.

Within the ethical and legal design of the Manufacturers Division of ARBA, we feel justified in pooling our interest and influence with yours in that we may use early peacetime years to fortify our industry against that future day when backlogs of construction will have been absorbed. Our general outlook is quite rosy at this

TROJAN

COMBINATION BULLDOZER AND SNOW PLOW
for
International Industrial Wheel Type Tractor



There is plenty of low cost power behind this newest Trojan Tool which has been carefully engineered to cover the widest possible use on all work requiring rubber tired tractors.

It may be used as a bulldozer or for snow removal. The three interchangeable units include a Bulldozer, V-Type Snow Plow and Reversible Blade Plow which may be used as a snowdozer or one-way plow.

Write for literature and specifications or see your International Industrial Distributor.

CONTRACTORS MACHINERY CO., INC.
Dept. RS 61 Batavia, N. Y.

time but only through healthy coordination of our respective interests in common goals can we plan and achieve a balanced economic sequence of construction projects.

Must Sell Public

In quest of new peacetime potency for our industry, we should thoroughly explore the processes of Public Relations. While certain formulae have known values, Public Relations as yet has not become an exact science. Our toughest problem is to reach beyond our own technical sphere into the layman's library, where John Q. Public reigns as a confirming sponsor of all that we may plan for America's future.

Gullibly to endorse publicity, merely for the sake of publicity, would be a confession that we had no sense of direction, not to mention poor public manners. As one successful publisher put it: "Whatever is right can be achieved through the irresistible power of an awakened and informed public opinion. Our suggestion, therefore, is not to inquire whether a thing can be done but whether it ought to be done and, if it ought to be done, to so exert the forces of publicity that public opinion will compel it to be done." Let us test our stepping stones as we go and proceed in ratio to our recognition of tangible values.

As manufacturers, we are appreciative of the opportunity we had to play a sustaining role, one which has helped guarantee the continuance of your ARBA functions during the turbulent war years and helped promote the birth of our $3,000,000,000 Postwar Road Program. General Fleming has referred to this program as "40,000 Miles of Auto Heaven." Unfortunately, John Q. Public seems to have gotten the impression that this road program is the all-inclusive and final answer to our highway problems. While our program does a facilitating job on access and regional highways and in the clearing of bottlenecks, there is still a vast national job to do. Let's be thankful, therefor, for our first impressive stepping stone, but, at the same time, guard against that complacency which might obstruct our vision.

Let's play ball together as we develop our new industry-wide peacetime salesmanship. As a harmonious industry, let us edify Mr. and Mrs. John Q. Public as to the economic stake every American has in a Road-United States.

•

E. L. Worthington New State Road Commissioner

E. L. Worthington, heretofore State Maintenance Engineer, has been appointed state road commissioner of West Virginia, succeeding E. L. Bailey. Mr. Worthington has been with the West Virginia state road commission for over 23 years, having started as a construction inspector in June, 1922. Between 1922 and 1933 he held the positions of inspector, draftsman, chief of survey party, junior engineer, senior engineer, and district construction engineer.

E. L. Worthington

In 1933 he was appointed district engineer of the Ninth State Road Commission District with headquarters at Lewisburg, which position he held until his appointment as state maintenance engineer in 1938.

Previous to his work with the West Virginia State Road Commission he worked in the testing laboratory of the Highway Department of North Carolina, and as an inspector of con-

you can tell . . .

IT'S A BUFFALO-SPRINGFIELD!

You can tell a lot by the "looks" of a piece of equipment. The smooth, compact appearance of a Buffalo-Springfield Roller is the outward evidence of leadership in design. Look at the control panel at the right. Just one of the "fine points" on a machine where no part is considered too small to get painstaking engineering attention. Ask your distributor for literature.

BUFFALO-SPRINGFIELD

The Buffalo-Springfield Roller Co.
Springfield, Ohio

The Oldest and Largest Builder of Road Rolling Equipment in America.

struction and maintenance work for the Maryland State Roads Commission.

Mr. Worthington received his engineering education at Johns Hopkins University, and the A.E.F. University, Beaune, France. He served nearly two years in World War I with the 23rd U. S. Engineers—15 months of which time was spent in France with the American Expeditionary Force.

•

(*Continued from page* 101)

	Miles	Est. Cost
Graded and drained* (Incl. bridges)	500	$15,000,000
Gravel or stone surfaced.	20	200,000
Low type bit.	330	5,000,000
High type bit.	70	2,000,000
P. c. concrete	30	1,800,000

* Roadbed construction for all types of surfacing.

California

An initial partial program totaling $40,000,000 has been approved by the State Highway Commission. This includes construction of 200 miles of state highway, 5 railroad grade separations, 48 highway grade separations and 80 new bridges. The bridges and grade separations will cost about $10,000,000. Up to Jan. 1 the State Highway Commission had taken bids on 43 projects estimated to cost $20,128,100.

(*Continued from page* 81)

AED and FTC Joint Trade Practice Conference

Henry Miller, Director of Trade Practice Conferences, Federal Trade Commission, presiding over a meeting held jointly with AED, urged that competition be kept alive and fair as an essential to the existence of free enterprise. He pointed out that the basic principle of fair trade practice is to bring the evils of unfair competition and trade abuses under control through voluntary cooperation in industry, implemented by rules worked out in conference and equitably applied in the conduct of the industry's business. The trade practice conference plan has been applied in more than 150 industries, and its efficacy proved beyond anything of an experimental nature. It is especially helpful to the small businessman (such as a contractor) who generally does not have a legal department.

Lowell T. Mason, FTC member, commented that the war had done away with competition and warned distributors against the results of relaxing government controls too rapidly.

H. W. Fletcher, speaking for AED, explained to the distributors that any action taken during this session would not be final, but that another conference will be held after mimeographed copies of the proposed trade practice rules have been circulated among the members for study and comment. The proposed rules express in specific language the things the law has always prohibited and that they are not intended to establish new restrictions. The members voted to accept the rules in the form prepared pending further study.

Thirteen specific rules were proposed, designed to foster the maintenance of fair competitive conditions in the interest of the industry and the public. These rules covered such subjects as the use of threat, intimidation or coercion against any distributor or other person to fix prices, suppress competition or restrain trade; misrepresentation of equipment, or character of business; false invoicing; deception on rebuilt or used machinery; inducing breach of contract; defamation or disparagement of competitive equipment; bribery, enticement of competition's employees; prohibition of discriminatory prices; rebates or refunds; below-cost selling; persuasion against independent price quotations.

It's On-the-Job Performance that Really Counts

The catalog claims, the salesman's sales talk are quickly proved or disproved "on the job". That's why we ask you to check our statements against the record. Hanson owners and operators everywhere endorse the matter-of-fact statement that "Hanson has the answer to your excavator needs".

Specifications in brief: ⅜ or ½ yd. capacity as a shovel – 4½ or 6½ ton lift as a crane – all welded steel construction – Timken Roller Bearings at vital points – bronze bushings at all other points of wear – chain crowd – full revolving – low center of gravity – special Hanson clutches, easily adjusted and relined without dismantling shafts – extra long crawlers – air controlled steering – heavy duty industrial type gasoline or diesel motors – quickly convertible to: CRANE, DRAGLINE, CLAMSHELL, PILE DRIVER, TRENCH-HOE, SHOVEL.

Write for complete specifications and catalog ER-26.

THE HANSON CLUTCH AND MACHINERY CO. TIFFIN, OHIO

Committee Reports

The fact that AED is a hard-working organization on a year 'round basis was emphasized by the reports given by the committee chairmen which included the following:

National Affairs, Wm. A. Danner, Hyde Park, Mass.; Membership, Charles M. Woolley, Tractors, Inc., Providence, R. I.; Catalog, G. F. Lowe, Lowe Machinery Co., Chicago; "Construction Equipment News"; Morton R. Hunter, Hunter Tractor & Machinery Co., Milwaukee; (editor); Hotel Reservations, G. E. Hillsman, Hillsman Equipment Co., Chicago; Advertising, A. L. Overton, Overton and Ross Dallas; Planning and Promotion, W. G. Clark, Tri-State Equipment Co., St. Louis; Rental Committee, Eldon M. Farnum, Allied Construction Equipment Co., St. Louis; Local Groups and Regional Committee, A. E. Hahnan, Tractor & Machinery Co., Inc., Atlanta.

The reports showed increased membership with a corresponding increase in activities and responsibilities. The tone of the reports indicated AED's dislike of the restraint imposed by government controls, and shows the feeling that the trend away from free enterprise is detrimental not only to their industry, but to the nation as a whole.

•

Oregon to Let Sixteen Million by June

The latest expectation of the Oregon state highway commission is that about sixteen million dollars' worth of road projects will be under way by mid-year, according to state highway engineer R. H. Baldock. Nearly six million dollars was under contract by January 1. This start is toward a three-year goal of 36 million dollars to be spent in the postwar program.

Mr. Baldock said that the labor situation has eased this winter in Oregon, and that the highway commission has received many applications from both skilled and unskilled workers. The central highway shop at Seattle at least has a normal crew.

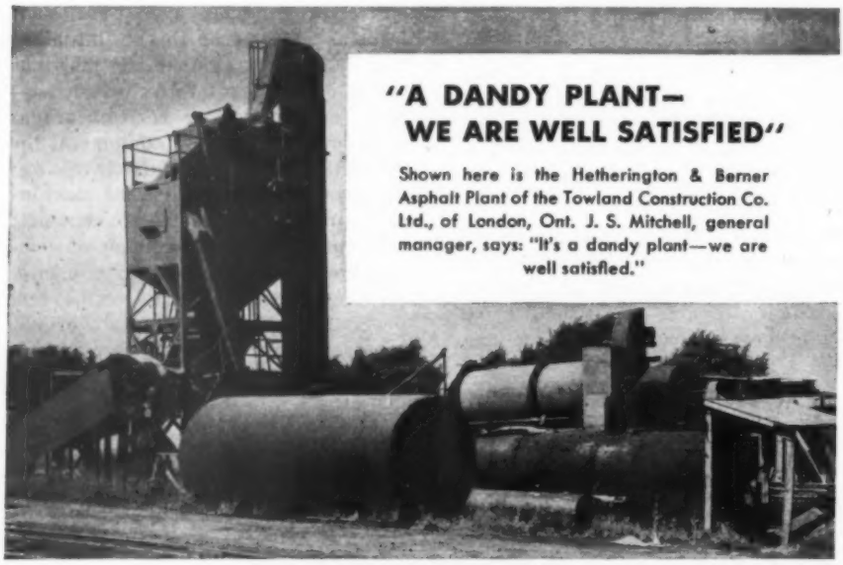
•

Cook County to Vote on $70,000,000 Bonds

Chicago citizens possibly in June, will be given a chance to vote a 70,000,000 county bond issue for highways. The bond referendum was postponed from the April primaries. The money would be spent on approved superhighways including Congress Street extension; the Northwest Highway to the new Douglas Air Terminal; Eden parkway, the northwest's connection to the north; and the Calumet parkway, connecting with the proposed Chicago-Detroit expressway. The bonds are to be retired over 20 years out of the county's share of gasoline taxes. Meanwhile design work is progressing with the help of a $100,000 grant from state postwar planning funds.

•

Contract Time May Be Extended—The state highway department of Texas has notified contractors that if their inability to secure steel products due to the labor troubles in the steel industry made it necessary for them to suspend or substantially curtail operations on highway department contracts, their contract time charges would be suspended and they would not be considered in default of contracts for the period during which such essential materials were not available.



"A DANDY PLANT— WE ARE WELL SATISFIED"

Shown here is the Hetherington & Berner Asphalt Plant of the Towland Construction Co. Ltd., of London, Ont. J. S. Mitchell, general manager, says: "It's a dandy plant—we are well satisfied."

H&B ASPHALT PLANTS

—FOR TIME-SAVING, COST-CUTTING PRODUCTION

Modernize your old plant by installing FLUIDOMETER, the automatic asphalt metering system. Saves time, materials, insures accuracy and uniformity. For all types of plants. Write for Bulletin F-44.

● A satisfied owner is the best advertisement any equipment can have. Hetherington & Berner asphalt plants have many such advertisements—in all parts of the U. S. and in Canada. For over 75 years these plants have been satisfying their owners by giving dependable, economical production, with low maintenance costs.

America's first builders of asphalt mixing equipment, H & B today offer the very latest improvements and refinements in design in both portable and stationary plants of all types and capacities—from the smallest patch plants to the largest stationary models.

Get ready now for the busy years ahead. Write for literature on the type of plant in which you are interested.

HETHERINGTON & BERNER INC.
721 Kentucky Avenue • Indianapolis 7, Indiana

H&B Hetherington & Berner

(*Continued from page* 103)

3. Tell an employee in advance about changes that will affect him. Tell him WHY if possible. Get him to accept the change.

4. Make best use of each person's ability. Look for ability not now being used. Never stand in an employee's way.

PEOPLE MUST BE TREATED AS INDIVIDUALS!

These foundation principles are also derived from the experiences of successful supervisors and have proven their worth time and again. Since these principles apply to dealings with people and since contractors are individuals it is believed these principles will stand the engineer in good stead. The writer advocates the application of these principles by the engineer in his dealings with the contractor and with all other individuals involved in the solution of his problem. Such engineers as accept and try out the plan are asked to give it a fair trial, carefully reviewing the attention they gave each step of the plan and the foundation principles when they finally answer the question "Did your action help production?", especially if the solution isn't completely satisfactory.

CONCLUSION

The writer has placed most of the responsibility for improving Engineer-Contractor relationships on the shoulders of the engineers. The contractors cannot escape their fair share of this responsibility, but collectively can do less to improve these relationships than can the engineers. In this article the writer has adapted a plan developed for another purpose to suit the solution of problems facing engineers. The writer has no doubt that the plan is equally adaptable to the contractor's problem in relation to his dealings with engineers. It is suggested that such contractors as read this article give some thought to their part in improving the relationship which is bound to exist between them and the engineers and determine whether or not some application of the plan and the foundation principles will work for them. They might well also seriously consider the following statement by the writer and do whatever they can to hurry the day referred to. I believe that with the arrival of the day when no one can with any degree of honesty refer to engineers as educated laborers and when engineers are paid salaries commensurate with the educational and professional attainments required of them to insure their being capable of doing a good job, that same day it will no longer be correct for me to describe contractors as business men with a pronounced flair for gambling.

My experience with projects where relations were good as well as with jobs that caused lots of trouble, leads me to have a good deal of faith in the merits of the plan I have described. The fundamentals of the plan aren't original with me and its application will be readily recognized as plain hard work. It is believed, however, that it has not been set forth previously step by step. Successful engineers have instinctively applied it and have obtained good results. This plan is offered for consideration and adoption in whole or in part with the hope that it may prove of value to the profession thereby placing it in a position to command additional respect, its members in position to command better pay, and of value to the contractors by removing some of the hazards of their industry.

•

Gas Tax Increases Proposed—Bills before state legislatures of Massachusetts and Mississippi propose increase in gas tax. The governor of Virginia has recommended a 1c increase in the gas tax.

BARNES NEW AUTOMATIC *Centrifugal* PUMPS

mean *Smoother* LOOKS, *Smoother* PERFORMANCE, *Smoother* SELLING FOR DEALERS

It has not been merely a face-lifting job at Barnes. Barnes new automatic centrifugal pumps are completely new — setting a new standard in pump appearance and performance. It did not take pump buyers long to realize that these startling new pumps were actually giving "more gallons of water for their pumping dollar." That's buyer acceptance!

Now, Barnes offers an array of hard-hitting selling helps to the dealer that match the performance of Barnes Pumps — Personal Service and Field Training . . . Advertising in National and Sectional Papers . . . Catalogs, Folders, Cuts . . . Instruction and Service Manuals . . . Tested Sales and Merchandising Practices — *that's dealer cooperation!*

The farsighted and profit-minded distributor will want to handle the Barnes Line. Choice territories are still open. Write, phone, or wire

BARNES MANUFACTURING CO

Quality Pump Manufacturers for 50 Years

MANSFIELD, OHIO

FULL HP TEST RUN
Double-Checks Power Output of All
WISCONSIN ~~Air-Cooled~~ Engines

Every 4-cylinder V-type Wisconsin Engine, as well as all single cylinder engines from the smallest to the largest, are put on a 4-hour test run (the last hour under full load), working against a specially designed water brake.

This not only serves as an operating check on power output, but also provides a valuable *functional pre-test* of every working part . . . because no engine is any better than its smallest individual part, nor all of the parts working together in perfect mechanical coordination.

All this is important in relation to the work these engines may be called upon to do when *powering your equipment.*

Most H.P. per pound
WISCONSIN MOTOR Corporation
MILWAUKEE 14, WISCONSIN, U. S. A.
World's Largest Builders of Heavy-Duty Air-Cooled Engines

Shunk
GRADER AND SCARIFIER BLADES

For any type or make of machine—Motor Graders, Maintainers, Scrapers, Drags, Bulldozers, Backfillers, Wagon Scrapers, Trail Builders, Trail Blazers, Carryalls, Snow Plows. Also—CUTTING EDGES, WEARING BOOTS, BACK SLOPERS, EXTENSION BLADES, MOLDBOARDS and SCARIFIER TEETH

50 years of specializing in the manufacture of Construction Equipment Blades has developed for your benefit a quality of special steel, milled through our own rolls and forged at the edges to give that extra cutting and wearing quality you need.

Furnished in various widths, lengths, and thicknesses, punched ready to fit your machine.

Consult your internationally recognized Blade Specialists. Write for special bulletins, giving type and name of machines you operate—get set for Blades early.

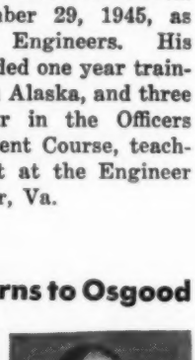
Shunk
MANUFACTURING COMPANY
Established 1854
BUCYRUS, OHIO

WITH THE MANUFACTURERS & DISTRIBUTORS

New Representative for Galion

Robert H. Burnup, Independence, Mo., has been appointed district representative by the Galion Iron Works & Mfg. Co., Galion, O., for the states of Nebraska, Kansas, Oklahoma, Missouri and southern Illinois. Mr. Burnup entered the army December 20, 1940, a private and was released from active duty December 29, 1945, as Captain, Corps of Engineers. His service record included one year training, and one year in Alaska, and three years as instructor in the Officers Mechanical Equipment Course, teaching road equipment at the Engineer School, Fort Belvoir, Va.

Maynard Returns to Osgood



Robert Maynard

Lieut. Robert Maynard has returned to his position as export manager for Osgood and General Excavator. He will handle all export sales and advertising of the companies' shovels, cranes, draglines, backhoes and similar equipment. Mr. Maynard recently was discharged from the Navy after serving three years. While on special missions, he saw action in all the principal Pacific theaters of war. Prior to coming to Marion, he was associated with a New York export firm.

Branch Changes by International Harvester

International Harvester Co. has announced the following changes in branches and in branch management personnel: Separate motor truck branches have been established at San Antonio and Houston, Tex. They will handle motor truck sales, parts and service exclusively. Management personnel has been selected from the staffs of the respective general line

(*Continued on page* 128)

F. A. Road Building by County Forces

The Public Roads Administration has cleared the air on the much discussed matter of force account construction of Federal-aid secondary roads. In its General Administrative Memorandum No. 297, issued January 17, 1946, the following statement is made over the signature of Commissioner Thos. H. MacDonald:

Experience has demonstrated the economy and efficiency of the contract method of construction for highway projects, and it would be inadvisable to encourage construction of Federal-aid secondary projects by county forces. Nevertheless, because of the minimum character of the improvements which will be adequate for certain classes of secondary roads, we will consider construction by county forces favorably when recommended by the State highway department, with a showing that:

1. The character of the work or the circumstances surrounding the project make it unsuitable for economical construction by the contract method. Projects of a substantial character which are customarily constructed by the State highway department under the contract method should not be recommended for construction by county forces. Projects which might be suitable for construction by county forces, for example, would include extensive light grading and surfacing, or the installation of permanent culverts as stage construction.

2. The county is adequately organized and equipped to perform the work. Construction by county forces should not be recommended where it would be necessary for the county to purchase construction equipment not required for its normal operations.

3. The cost is reasonable.

The work to be performed, the manner of construction, the estimated cost and any other conditions should be clearly stated in an agreement between the State highway department and the county, copies of which will be made a part of the plans, specifications and estimates. Surveys and plans may be of the minimum character described in General Administrative Memorandum No. 283, but shall be at least sufficient to establish an accurate measure of the quantities of work to be done. The estimated cost of the work should be established on the basis of these quantities and agreed unit prices, but these agreed unit prices should not be determined as the result of direct competition by the county with private contractors bidding on the same project.

The agreement between the State and the county and the unit prices specified therein shall be subject to concurrence by the Public Roads District Engineer, and will form the basis for the amount of the Federal-aid project agreement between the State and the Public Roads Administration in the same manner as the contract award on projects undertaken by the contract method. Federal reimbursement to the State will be based on the quantities of work performed computed at the unit prices shown in the State's agreement with the county. The agreed unit prices should not exceed prices on comparable contract work. Use of county equipment cannot be considered as a partial contribution in lieu of funds required to match Federal funds, nor will Federal reimbursement be made to cover direct charges for rental or depreciation of publicly owned equipment.

The State highway department will be responsible for the same degree of supervision and inspection as on a project constructed by contract.

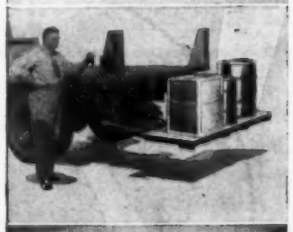
General Administrative Memorandum No. 40 is modified to the extent that it otherwise would apply to construction by county forces.

Anthony HAS IT...

CONSTRUCTION EQUIPMENT THAT KEEPS TRUCKS ON THE MOVE

- ANTHONY "SUPER" HYDRAULIC HOISTS AND BODIES, up to 30 ton capacity — with "power speed lift" and "rubber restraining blocks," two of many features that explain the evident preference for Anthony equipment on the job.

- ANTHONY HYDRAULIC LIFT GATE . . . one of the remarkable new war-developed pieces of equipment for loading and unloading. Raises and lowers loads from ground to truck level.



- ANTHONY MATERIAL SPREADER . . . rugged, all steel; for road building, maintenance and ice control.
- ANTHONY HYDRAULIC PLATFORM "BOOSTER" HOISTS, especially designed to make dump bodies out of flat bed trucks.

Write for complete details on any Anthony product. Available through all truck dealers and Anthony distributors.

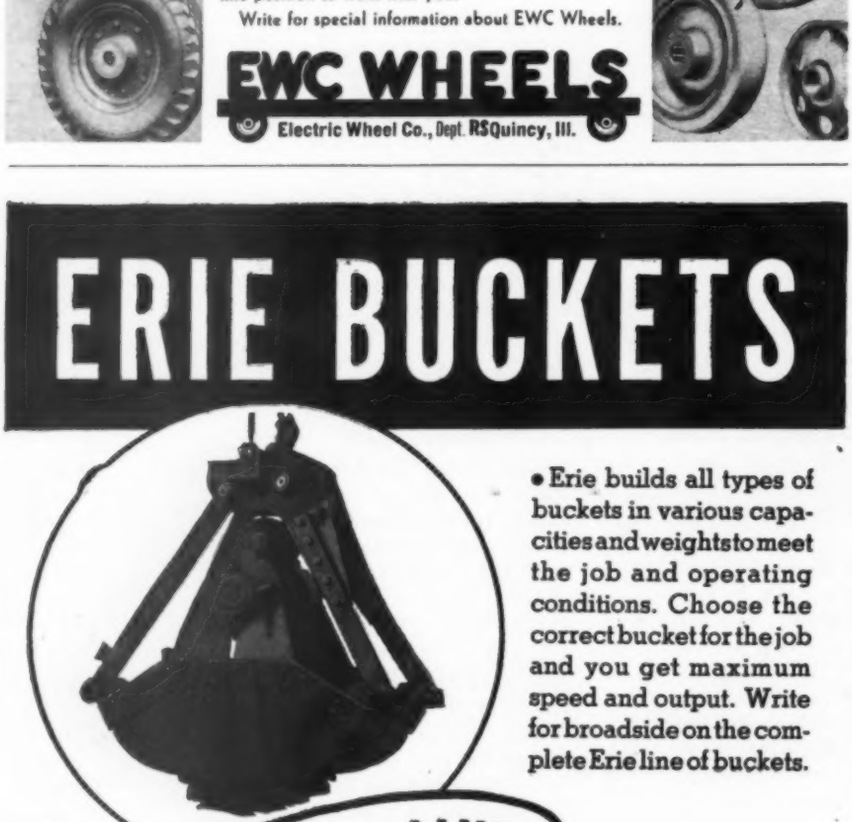
ANTHONY HYDRAULIC

Manufactured by ANTHONY CO. Streator, Ill.

(*Continued from page* 126)

branches, which will continue in operation without other change. T. R. Moulder, formerly assistant manager in charge of motor trucks, has been named manager of the new San Antonio motor truck branch. C. T. Helin has been similarly advanced from assistant manager in charge of motor trucks to manager of the new motor truck branch at Houston. E. M. Moore, who has been retail motor truck manager, has been appointed assistant manager of the Houston motor truck branch. Other recent branch management changes announced by International Harvester are as follows: M. J. Gowan, previously assistant manager at the Cincinnati motor truck branch, has been made manager of the Richmond, Virginia, motor truck branch. L. C. Carroll replaces Mr. Gowen as assistant manager at Cincinnati. He has until recently been retail motor truck manager at the Columbus, O., branch. C. V. Ellis, who has been assistant manager of the Topeka branch, has been transferred to the Kansas City motor truck branch in the same capacity.

Round and Round They Go
All Over the World!
EWC WHEELS
We've been making good wheels for more than half a century—and had begun to get a little complacent about it—until people began telling us what a job EWC Wheels were doing all over the world. Our accumulated experience, and modern engineering combine to produce outstandingly fine wheels to meet every need. Now, with the most modern equipment to produce disc wheels, we are in a doubly fine position to work with you.
Write for special information about EWC Wheels.
EWC WHEELS
Electric Wheel Co., Dept. RSQuincy, Ill.


ERIE BUCKETS
• Erie builds all types of buckets in various capacities and weights to meet the job and operating conditions. Choose the correct bucket for the job and you get maximum speed and output. Write for broadside on the complete Erie line of buckets.
THE COMPLETE LINE
3512 GEIST RD.
ERIE STEEL CONSTRUCTION CO.
ERIE, PENNSYLVANIA
Aggre Meters • Buckets • Concrete Plants • Traveling Cranes

New Heil Appointments

The Heil Co., Milwaukee, Wis., has announced the appointment of Robert L. Miller as assistant sales manager, Road Machinery Division. Dan C. Pierce is sales manager, Road Machinery Division; and Len C. Andersen as manager of district sales. Ted Miller, who has long been identified with road machinery sales of The Heil Co., will take over as sales promotion manager for all divisions of the company.

Left to Right: Robert L. Miller, Dan C. Pierce, Len C. Andersen

Auto Gear & Parts Co. Incorporated

The Auto Gear & Parts Co., Philadelphia, Pa., which has been a partnership between George P. Henderson and Anna M. Henderson, has been incorporated under the laws of the State of Pennsylvania. All transactions in the future will be carried on by the corporation.

New Labor Relations Department

Establishment of a new Labor Relations Department at Caterpillar Tractor Co., to carry on the functions of the labor relations staff, formerly a part of the Industrial Relations Department, has been announced. The programs of the Labor Relations and Industrial Relations Departments will be administered by Ralph M. Monk, who assumes the title of Director of Industrial and Labor Relations. Mr. Monk joined "Caterpillar" in April, 1938, as Director of Industrial Relations, a position he has held since that time. George W. Torrence has been appointed manager of the new Labor Relations department and Warren Kinsey has been named Industrial Relations manager.

•

Arthur New Branch Manager

R. S. Arthur

Robert S. Arthur has been appointed Chicago Branch Manager by Littleford Bros., Inc., Cincinnati, O. He has headquarters at the Builders Building, 228 N. La Salle St., Chicago, and will handle the complete line of Littleford black-top road construction and maintenance equipment in this area. Bob Arthur has long been associated in the equipment field and his services and experience will be available to all in the Chicago area.

•

Pippinger Promoted by Adams

A. H. Pippinger of the J. D. Adams Manufacturing Co., Indianapolis, Ind., has been appointed district sales manager for the territory including Iowa, Minnesota, Nebraska, North Dakota, South Dakota, Wisconsin and the upper peninsula of Michigan. Mr. Pippinger entered the Adams organization as a salesman in the former Omaha, Neb., Branch in March, 1935, and was later transferred to an Iowa territory. In January, 1943, he was transferred to the Indianapolis headquarters for special sales work in connection with war contracts and continued in that capacity until his new appointment. He will make his headquarters in Minneapolis.

STEEL REINFORCING

For Real Service —

LET LACLEDE SUPPLY YOUR REINFORCING NEEDS FOR CONSTRUCTION OF HIGHWAYS, BRIDGES, AIRPORTS, CULVERTS AND DRAINAGE STRUCTURES. DELIVERY IS MADE TO THE JOB SITE WHEN NEEDED—COMPLETELY ENGINEERED AND DETAILED—READY FOR PLACING. A FULL LINE OF REINFORCEMENT IS AT YOUR SERVICE.

Depend on Laclede

LACLEDE STEEL COMPANY

GENERAL OFFICES ARCADE BUILDING ST. LOUIS, MISSOURI

Handle Material Faster and Cheaper with a SAUERMAN 1-MAN MACHINE

(View at Left) Sauerman Tautline Cableway of simple type is sole means of transport across river in South America. Handles thousands of tons of supplies yearly.
(View at right) Sauerman Tower Machine digs basin 1250 ft. long for sewage plant; loads spoil into cars at rate of 200 cu. yd. an hour.

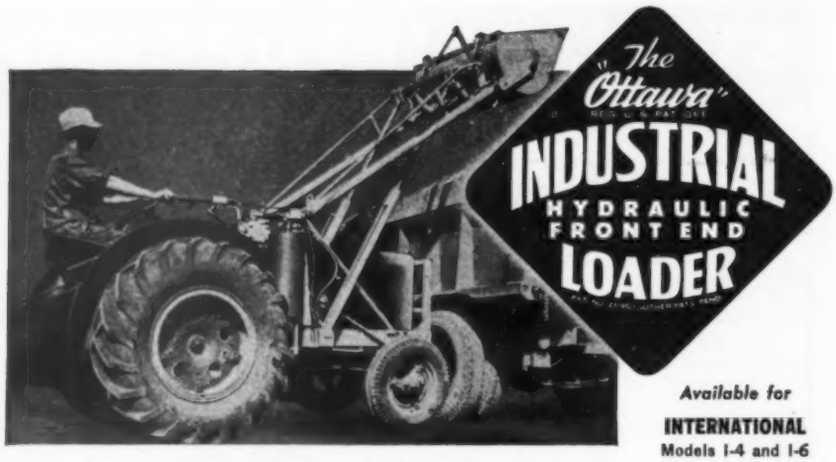
SPEED is the great need of these busy times and that is what you are assured when you use a Sauerman Cableway or Scraper machine for your long haul material-handling work.

A Sauerman machine can be installed to reach across a pit, pond, river or stockpile or up to the top of a hill and will move material at high speed from one point to another anywhere within its wide radius. The operation is smooth and flexible; requires relatively little power.

Sauerman machines are backed by over 35 years of experience in designing this type of equipment. We give you an expertly engineered machine, built to your exact needs. Whether it is an installation to handle a few hundred or many thousand cubic yards per day, it will be economical and easily operated by one man.

SAUERMAN BROS., Inc.

588 S. Clinton St., Chicago 7



Available for

INTERNATIONAL
Models I-4 and I-6

ALLIS-CHALMERS
"WC" with wide front wheels

OLIVER
"70" Industrial

MINNEAPOLIS-MOLINE
"RTI" and "UTI"

Lifts 3,000 Pound Load 8 Feet

The "Ottawa" INDUSTRIAL Hydraulic Front-End LOADER is a HEAVY DUTY Machine . . . it lifts 3000 pounds of Sand, Gravel, Rock, Coal, Steel Pipe, Dirt or Other Bulk Materials to a height of 8 feet quickly and easily . . . it assures operator perfectly CLEAR VISION at all times, is quickly and simply ATTACHED or DETACHED and is SHIPPED COMPLETE (there's absolutely nothing additional to buy or add) with complete HYDRAULIC SYSTEM including pump and valve. Bulldozer blade, Snowplow and Boom attachments are available. Write or wire today for FREE ILLUSTRATED FOLDER and prices. Immediate shipment.

Ottawa STEEL PRODUCTS, Inc.
OTTAWA 21, KANSAS

Weber New Service Manager

R. N. Weber

Ralph N. Weber has been appointed service manager for Le Roi Co., Milwaukee, Wis. He has been with the company for about 10 years, serving in various capacities in the catalog, purchasing and accounting departments. He has been active in the service department since July, 1941, as an order analyst and later as manager of the service order department. All through the war his concentrated efforts toward co-ordinating service production, processing, and shipment has been an outstanding factor in Le Roi's excellent record in meeting the government's heavy military demand. In his present position, in addition to the actual service department, he is also responsible for the service repair shop and the extensive field service program.

Higbee Appointed Sales Manager

Lester C. Higbee has been appointed sales manager for W. & L. E. Gurley, Troy, N. Y. He came with this company on May 1, 1915, and has served in various engineering, manufacturing, advertising and selling positions.

New Davey Distributors

Appointment of three new dealers has been announced by Davey Compressor Co., Kent, O. Those appointed were B & H Construction Equipment Co., 835 Meeting St., West Columbia, S. C.; A. L. Barnum & Son, Seneca Blvd., Burdett, N. Y., and Burton Equipment Co., New Orleans, La. Each dealer will handle the complete Davey line of portable and stationary compressors, including "Auto-Air" (truck-driven units) and power timber saws.

P. C. Reilly Honored

Peter C. Reilly, founder and president of the Reilly Tar & Chemical Corporation and Republic Creosoting Company, was honored at a dinner during a conference of branch managers, sales representatives and home office executives held in Indianapolis recently. The occasion marked the fifth decade of Mr. Reilly's operation of the business and its growth to one of the largest producers of coal tar products in the country. Company representatives and officials at the dinner are shown in the accompanying picture. Seated, left to right: George H. Jackson, Belle, W. Va.; Thomas E. Reilly, Indianapolis; P. C. Reilly, Jr., New York; C. B. Edwards, Indianapolis; A. E. Larkin, Minneapolis; Peter C. Reilly, Sr., Indianapolis; Wm. Higburg, Indianapolis. Standing, left to right: N. W. Locke, New York; E. J. Mootz, Indianapolis; W. F. Nixon, Indianapolis; J. H. Barnett, Jr., Chattanooga, Tenn.; T. G. Gannon, Chicago; Lawrence E. Hess, Indianapolis; B. P. Bogy, Jr., Indianapolis; W. A. Stelzer, Urbana, Ohio; M. Mitchell, Indianapolis; H. L. Holstrom, Minneapolis; G. J. Pierman, Columbus, Ohio; and G. J. Kucera, Fairmont, W. Va.

New Galion Representative

Galion Iron Works & Mfg. Co., Galion, O., has announced the appointment of Fred P. Vergon, Galion, O., as representative in the following Ohio counties: Erie, Huron, Ashland, Holmes, Wayne, Coshocton, Ottawa and Sandusky. Mr. Vergon entered the Air Corps, in January, 1941, as a flying cadet. He was awarded the soldiers medal for attempted rescue of pilot of crashed P-38. Explosion in the plane during rescue prohibited further rescue attempts. He was released from active service Oct. 26, as 1st Lieut., A.A.C., after serving 3 years as flying instructor.

Streamlined Inside
for Higher Efficiency and Lower Operating Costs

RUGGED SIMPLICITY OF DESIGN ELIMINATES RECIRCULATION —

NEVER LOSES PRIME REQUIRES LITTLE ATTENTION

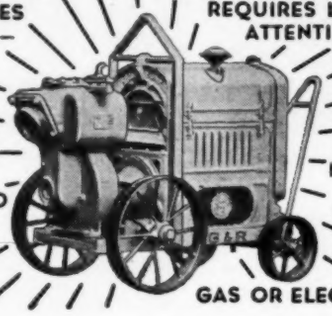
DELIVERS GREATER VOLUME PER GAL. OF GAS

NO ORIFICE OR PRIMING VALVES TO CLOG OR JAM

CAPACITIES UP TO 125,000 GPH

CLOSE COUPLED TO MOTOR

GAS OR ELECTRIC



Streamlined where it counts, you can't clog a Gorman-Rupp Self-Priming Pump. Unequalled in rugged efficiency, gallonage or continuous hours. A size and type for every need.

THE GORMAN-RUPP COMPANY, MANSFIELD, O

GORMAN-RUPP
SELF-PRIMING CENTRIFUGAL PUMPS

DESIGNERS AND BUILDERS OF PUMPS FOR SPECIAL NEEDS. Famous for soundly engineered reliability, Marine Products has set a record for world-wide service and low maintenance costs. Use M-P equipment in your field.

Industrial MP *Marine*
ENGINEERED EQUIPMENT

MARINE PRODUCTS COMPANY
6636 CHARLEVOIX AVE. • DETROIT 7, MICHIGAN

FOR YOUR SECONDARY ROAD CONSTRUCTION

Ariens
AGGMIXER

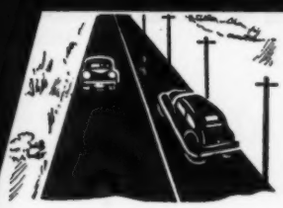
The swirling, chopping action of the tines does the job.

It's for roads like these that Ariens AGGMIXER was especially designed.

FOR mixed-in-place construction, Ariens Aggmixer is equipment designed especially for the job, operating in connection with other general purpose equipment. For use wherever aggregates are used, such as all types of bitumens, clays, cements, chlorides, etc., these materials are mixed without being displaced on the road surface. The Aggmixer thoroughly pulverizes, mixes and aerates the aggregates with the binder used, thoroughly, rapidly and economically. Safe and easy to operate . . . adjustable to any tractor . . . made in 4 sizes, with normal cutting widths 4', 5', 6', and 7'. Write for complete job facts and name of nearest distributor.

ARIENS COMPANY
BRILLION, WISCONSIN

cut down road glare reduce hazards



Concrete pavement is safer, easier to drive on when Emulsified Black is used to produce soft tones of grey or black. Not only is glare greatly reduced, but white markers stand out more strongly, reducing traffic hazards. Emulsified Black also hides unsightly oil stains.

Emulsified Black complies with State specifications. A colloidal dispersion of not less than 25% carbon black, it flows freely, working immediately into the mix. Emulsified Black requires no pre-mixing, and is easy and clean to handle. *For further information write to*

CARBON DISPERSIONS, INC.
27 HAYNES AVE., NEWARK 5, N. J.
TEL. BIGELOW 3-4611

BLACK SHIELD CD

RAPID!

Cuts concrete and cuts labor costs to 2½c per square yard. Applicable to floor work and different types of inside horizontal work.

Very efficient in maintenance work of highways.

Boom folds down and readily trailed by any light truck. Make your compressor treble its output by hooking it to this machine.

Rapid Pavement Breaker Co.
1517 Santa Fe Ave.
Los Angeles 21, Calif.

Better

WEED CONTROL

this Season

WITH **2-4D**

Tested and approved by leading agricultural colleges.

Weedeath
TRADE MARK

The Perfected
2-4D WEED KILLER
Will Do The Job!

- COMPLETELY WATER SOLUBLE
- DOES NOT DETERIORATE

Write or wire dept. (s) now for quantity discounts!

HOWARD HANSON & CO.
Agricultural Chemicals and Hormones.
BELOIT, WISCONSIN

Appointed Sales Engineer for Worthington

Paul La France

Paul La France, recently released from the U. S. Navy with the rank of Lieutenant Commander, has been assigned as a sales engineer for the Construction Equipment Division of Worthington Pump and Machinery Corporation with headquarters in Washington, D. C. La France has been connected with the construction business since his graduation from Yale University in 1925, entering the equipment field in 1941. During the war he served with the 57th battalion of the Seabees.

Harrison-New Vice President Buffalo-Springfield

The Buffalo-Springfield Roller Co., Springfield, O., has announced the promotion of J. F. Harrison, chief engineer and works manager, to vice president in charge of engineering and manufacturing. Mr. Harrison, who has been in the engineering field for more than 23 years, is the holder of many patents pertaining to construction equipment and has been directly associated with the pioneering of many new developments in the construction equipment industry. He is also a licensed professional engineer. Prior to joining Buffalo-Springfield in 1941, Mr. Harrison was associated in engineering capacities with other construction equipment manufacturers.

White Back From Army

W. McKean White, Jr., Elkhart, Ind., has been released from active duty as a Captain in the Army Air Forces and appointed a Captain in the Air Reserve. He has returned to his pre-war position as Vice-President of the White Manufacturing Co., Elkhart, Ind. During the war Captain White served for two years in England in the 8th Air Force. He was an engineering officer, and eventually became Group Equipment Officer of the 384th Bombardment Group. As vice-president of the White Mfg. Co. he will be active in engineering and production problems as assistant to his father, W. McK. White, President.

NOW AVAILABLE
One-man Diesel Valve Spring Tool

SAFE-N-EZY Valve Spring Depressor CUTS Diesel Maintenance COST!

The SAFE-N-EZY Valve Spring Depressor is designed for one-man operation in dismantling and assembling Diesel engine valves. Compresses valve spring to any point, holds it there. Mechanic can have both hands free. Easy to apply. Sizes to fit all modern Diesel engines. Rugged, light, easy to store. Makes Diesel valve dismantling and assembly safe, easy, quick.

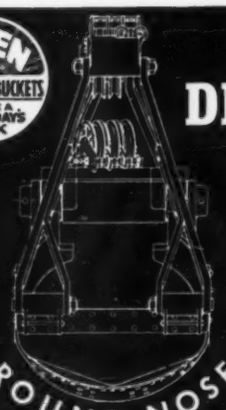
PAXTON
DIESEL ENGINEERING COMPANY
OMAHA 5, NEBRASKA

'ALL THE YEAR ROUND'

The BURCH TRUK-PATROL will pay its way because it can be used all the year 'round. Road and shoulder maintenance, cutting down high shoulders, building up low, cleaning shallow drainage ditches, clearing ice and slush from paved roads and many other jobs it is especially adapted to do. HYDRO-MOTOR controlled and that means control with a "feather touch".

Manufactured by
The BURCH CORPORATION
Crestline, Ohio
Equipment since 1875
BUY VICTORY BONDS

OWEN CLAMSHELL BUCKETS INSURE A BIGGER DAY'S WORK



ROUND NOSE

Distinctive DIGGING FACTORS

In digging with an Owen round nose bucket, the total pressure is exerted on a portion of the cutting edges at the center of the lips. Before this weight becomes distributed over the entire width of the cutting edges, the lips have penetrated deep into the material with a carving action. This gives larger grabs and lowered operating costs.

for GREATER *penetration*

THE OWEN BUCKET CO.
6070 BREAKWATER AVE., CLEVELAND, O.
BRANCHES: New York, Philadelphia, Chicago, Berkeley, Cal.

IN CLEVELAND
IT'S THE

HOLLENDEN

HOME OF THE FAMOUS
VOGUE ROOM
1000 ROOMS WITH BATH
RADIO IN EVERY ROOM
FIVE FINE RESTAURANTS
CENTRAL DOWNTOWN LOCATION

The Sign of Safety

TUTHILL

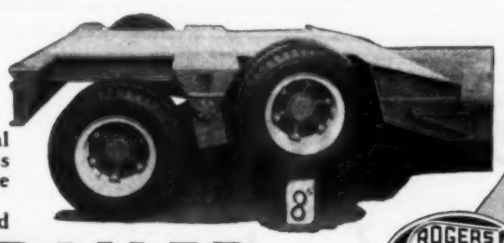
—the Safer Guard Rail that Stands up Better

TUTHILL Highway Guard has that combination of features Highway Engineers like so well: A high degree of *safety, easy installation* and *low upkeep expense.* Made of strong steel, with panels cut to convenient length, this Guard is easy to install. Its strength to resist impact, and yet stand erect, means greater safety, besides a neater-looking, more permanent job. Proof? The hundreds of TUTHILL Guards along America's scenic highways. Available for maintenance or installation. *Write for details.*

Pacific Coast Manufacturers and Distributors:
U. S. SPRING & BUMPER CO., Los Angeles, Calif.

TUTHILL SPRING COMPANY
761 W. POLK ST. CHICAGO 7, ILL.

A ROCKING BEAM *Trailer?*



Rogers also builds trailers for unusual needs, embodying characteristic features of fundamental design but modified to meet the special requirements.

For example, consider the above illustrated

ROGERS TRAILER

YES HERE IT IS!

• This is the new Model T trailer which has two rocking, box-girder sections at each end of which is a spindle, carrying a wheel and two extra large tires. This design gives the desired oscillation and permits building trailers only 8 feet wide in capacities up to 35 tons. This two axle trailer meets the needs existing in some states that limit the tonnage that can be carried on one axle.

Write for information on standard or special trailers which have been tested in difficult service.

ROGERS HEAVY DUTY Transcontinental Trailers

EXPERIENCE ....builds 'em

ROGERS BROS. CORP.
138 ORCHARD ST. ALBION, PA.

PERFORMANCE .....sells 'em

CLEARING HOUSE

TIRE REPAIRS

All sizes truck, tractor up to and including 3400x 32-36 ply tires. Our Equa-Flex repair is built for heavy and rough work.

Farm tractor and passenger tires are guaranteed for the life of the tread.

WALLACE TIRE SERVICE, Inc.
2329 S. Michigan Ave. Chicago 16, Ill.

POSITION WANTED

Sales Representative for Asphalts and Road Oils in the State of Wisconsin. Have had several years experience in the bituminous roads construction business. Box 100, Roads & Streets, 330 S. Wells St., Chicago 6, Ill.

For Sale

Concrete Reinforcing Bars
Deformed and Plain
Warehouse Stock

Large Tonnage

Glazer Steel Corporation
610 Chamberlain St. Phone 3-0738
Knoxville, Tenn.

Latin American Service Engineer Available

Responsible U. S. graduate Civil Engineer, Colombian, 35, single, speaking Spanish and English fluently, with highway construction experience, wishes to act as Service Engineer to work with Latin American local engineers and highway officials and assist buyers in setting up, adjusting and operating of equipment. Willing to undertake factory training, field servicing, foreign sales policy, etc. Personal and business references on request. Box 10, Roads & Streets, 330 So. Wells Street, Chicago 6, Ill.

WANTED
CHIEF DESIGNING ENGINEER

for road building, material handling, and heavy automative equipment. A man who has had wide experience in these fields as well as in high pressure hydraulics. Capable of assuming full responsibility for an engineering department of 15 engineers and draftsmen. State age, experience, qualifications and salary requirements. Confidential. Position in Middle-West. Box 101, Roads & Streets, 330 So. Wells Street, Chicago 6, Ill.

WANTED

Asst. Sales Mgr. Const. Equipt. Man with successful record selling dirt moving equipt. for an exceptional opportunity with large Eastern distributor. Good salary, expense and commission.

Box 103, Roads & Streets
330 So. Wells Street, Chicago 6, Ill.

WANTED
SALES ENGINEER

Western Corp. desires applicants for sale of Highway Equip. to Highway Commissions, contractors, and heavy equip. users in West. Work out of Denver office. Qualifications: Grad. Engr. or equiv. field exp. in highway or heavy constr. work. Five yrs. exp. in sales of steel or heavy equip. Age 30 to 40. Salary open. Apply by letter.
Box 102, Roads and Streets, 330 So. Wells St., Chicago 6, Ill.

WANTED

Experienced design engineer on snow removal or allied equipment for immediate and permanent employment by progressive Central New England steel plate fabricating concern, in business for the past half century.

Box 104, Roads & Streets
330 So. Wells Street, Chicago 6, Ill.

WANTED—ASPHALT PLANTS

1 or 2 Ton Cap. Main Plant
1 Portable Road Plant

E. J. BOYCE
Pierce Bldg. St. Louis, Mo.
or
THE DARIEN CORPORATION
Darien Conn.

TRANSITS and LEVELS

New or Rebuilt
Sale or Rent

Headquarters for REPAIRS—any make. Factory service. We will also *buy* your old instruments or take them in *trade*.

A complete line of engineering Instruments and Equipment for Field or Office. Write for Bulletin RS-112.

WARREN-KNIGHT CO.
Manufacturers of Sterling Transits and Levels
136 N. 12th St. Philadelphia 7, Penna.

ASPHALT PLANTS

5—¼, 1 & 1½ Ton Portable & Stationary.

GAS ROAD ROLLERS

3 Ton Tandem—10 Ton 3 Wheel.

NEW GENERATING PLANTS

37—1½, 5, 10, 15 & 25 KW Kohler, Hill & Caterpillar Gas & Diesel.

ASPHALT TANKS

2—16,000 Gal. 10 lines heater coils, at Newark, Ohio.
16—10,000 Gal. Car Tanks at Chicago—New Orleans—Phila.—Houston.

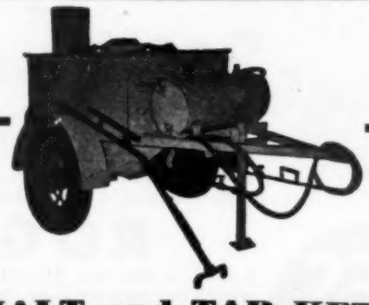
L. M. STANHOPE
ROSEMONT PENNA.

USED SNOW REMOVAL EQUIPMENT FOR SALE

One Allis Chalmers K tractor with cab, full hydraulic Wausau plow.
Two caterpillar RD-6 tractors, cab, full hydraulic plows.
One caterpillar D-8 Wisconsin Special Tractor plow.
One caterpillar D-8 Wausau Tractor plow.
Two winter cabs for caterpillar D-8 tractors.

COLUMBIA COUNTY HIGHWAY COMMISSION
Portage, Wisc.

Buy More Victory Bonds



ASPHALT and TAR KETTLES

FIRE PROOF—OIL BURNING
Hand and Motor driven spray.
Many sizes. Write for catalog.

Elkhart White Mfg. Co. Indiana

Finland Distributor for Davey

Maskin-Agenturen, B. S. Hjelt, 11 Sandvikskajen, Helsinki, Finland, has been appointed distributor of Davey air compressors for that country. Organized in 1936, this distributor retained its corporate identity throughout the war, and holds dealerships for a number of other U. S. firms including the Athey Truss Wheel Co., Caterpillar Tractor Co., Hyster Co., etc. Managing partner of the company is Bror S. Hjelt.

South Bend
GUTTER-SNIPE
PICK-UP STREET SWEEPERS
•
STREET FLUSHERS
STREET SPRINKLERS
BITUMINOUS DISTRIBUTORS
BITUMINOUS MAINTENANCE UNITS
•
Since 1908
MUNICIPAL SUPPLY COMPANY - SOUTH BEND 23, INDIANA

LA CROSSE
HEAVY DUTY
MACHINERY TRAILERS
BUILT BY
LA CROSSE TRAILER & EQUIPMENT CO
LA CROSSE, WISCONSIN

VULCAN PAVEMENT AND CLAY DIGGING TOOLS
ARE MADE in a complete line of sizes to fit all standard compressed air hammers.
Send for NEW Vulcan illustrated CATALOG today.
VULCAN TOOLS — THE WORLD OVER — NOTED FOR QUALITY AND DURABILITY"
VULCAN TOOL MFG. CO.
QUINCY, MASS.

Shingleton Rejoins Goodrich

E. C. "Pete" Shingleton has rejoined the advertising and sales promotion department of The B. F. Goodrich Co., Akron, O., after nearly 42 months in the armed services, 21 of which were overseas in the Pacific theater. He will handle sales promotion programs on truck, farm, off-the-road and industrial tires and tubes. He joined B. F. Goodrich in 1937 and after sales promotion work in the field was brought to the company's principal offices in Akron, O., in 1938.

New Lima District Manager

Paul Fenwick

Paul Fenwick has been appointed district manager in the states of California, Arizona, and Nevada for Lima Locomotive Works, Inc., Shovel and Crane Division, Lima, O. Mr. Fenwick has been associated with the shovel and crane industry since his graduation from the University of Illinois, except during the war, in the successive capacities of manufacturing, design, and field sales. The Army ordered him to active duty in August, 1941, and he served with the Transportation Corps until his release in December, 1945, as a Lt. Colonel. He assumed his new position with Lima in February.

Gulick Promoted by Goodrich

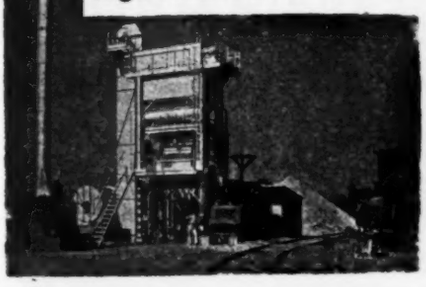
J. E. Gulick has been named general manager of the tire manufacturing division of The B. F. Goodrich Co. Gulick, who succeeds A. W. Phillips, resigned, will direct all tire manufacturing operations of the company in the United States.

LeTourneau Distributor Organization

Fifty-seven exclusive LeTourneau distributors now comprise the domestic sales organization recently announced as complete by R. G. LeTourneau, Inc., of Peoria, Ill. Providing fully adequate sales, service and parts facilities, the distributing firms serve earthmoving and construction owners and users throughout the United States and Canada, with representation in 91 cities. This newly-formed sales structure was developed under a sign-up program inaugurated in February, 1944. Divided into three divisions—Eastern, Central and Western—the various firms are kept in constant touch with the factory by LeTourneau District Sales Representatives and servicemen. Factory parts and credit facilities are provided. Expert field engineering consultation service is available, and an extensive advertising program is offered to promote the individual distributor, as well as LeTourneau.

THAW CULVERTS and HYDRANTS with an AEROIL

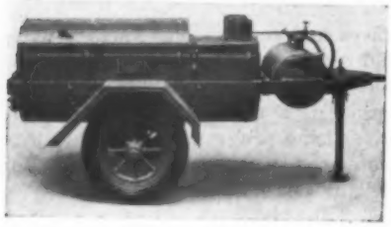
No. 98 Portable Steam Thawer
A handy steam plant with a detachable thawing torch. Used by leading Highway Departments for Culvert Thawing. Special Culvert Nozzle (10 ft.) available. Send for WINTER CATALOG No. 234-S including Concrete Heaters, Portable Coil Water Heaters, Thawing Torches, Ground Thawers, Salamanders, Tar and Asphalt Heaters, etc.
AEROIL PRODUCTS CO., INC.
5717 PARK AVE. WEST NEW YORK, N. J.
Branches: Chicago, San Francisco, Dallas

PORTABLE ASPHALT PLANTS
High Production—Low Cost

THE McCARTER IRON WORKS, INC.
NORRISTOWN, PENNA

RELIANCE
CRUSHING, SCREENING and WASHING UNITS
● Up to 2000 Tons a Day ●
Crushers, Elevators, Sweepers, Screens, Wash Boxes
Bins, Pulverizers, Feeders, Spreaders, Kettles, Conveyors
Drag-Lines "GAYCO", Centrifugal Air Separators
UNIVERSAL ROAD MACHINERY CO.
Kingston, N. Y.
Canadian Representatives: F. H. Hopkins & Co., Ltd. 340 Canada Cement Co., Montreal, Que., Can.

New "SPEED-MASTER" Melting Kettles

for TAR • ASPHALT BITUMINOUS COMPOUNDS



Internal Tube Heating System — Easily Removable for Quick Cleaning

- **DOUBLES OUTPUT**
- **CUTS MELTING TIME AND FUEL IN HALF**

Also ask about
Compound Melting Furnaces
Asphalt Surface Heaters
Concrete Heaters
Steam Generators
Torch Burners
Rivet Forges

Immediate delivery on the best producing oil-burning kettle—40-, 55-, 80-, 115-, 165-gal. capacities—on skids, on pneumatic tires or steel wheels. Also with hand or power spray attachments for distributing hot bitumen. Write for catalog.

HAUCK MANUFACTURING CO.
119-129 TENTH STREET
BROOKLYN 15, N. Y.

EMBURY
Luck-E-Lite
HIGHWAY TORCHES

Order through Your Jobber
EMBURY MFG. CO., WARSAW, N. Y.

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